

**THE PEA PATCH ISLAND
HERONRY REGION
SPECIAL AREA MANAGEMENT
PLAN**

PROGRESS REPORT

JUNE, 2001



Purpose of the Special Area Management Plan

The Pea Patch Island Heronry is the largest heronry on the East Coast (north of Florida) and is a resource of both regional and national significance. The purpose of the Pea Patch Island Heronry Region Special Area Management Plan (SAMP) is to build and apply the knowledge and commitment necessary to ensure the long-term protection of resources that support the Pea Patch Island Heronry through a broad-based, ecosystem approach. The Special Area Management Plan was the result of efforts by a wide range of federal, state and local governmental organizations as well as businesses, industry and not-for-profit groups. When complete, the SAMP outlined 27 strategies in seven issue categories aimed at protecting and improving resources within a 15-km radius of the island.

A SAMP Implementation Team has been working cooperatively since 1998 to carry out the strategies outlined in the SAMP. Since implementation of strategies has begun, 21 of the 27 strategies in the SAMP have been implemented.

About this Document

The purpose of this SAMP Progress Report is to comprehensively update the status of each SAMP strategy, provide information on important changes that have occurred in the heronry region and to outline the policies of the SAMP.

This Progress Report will provide the basis for Implementation Team members to evaluate the success of the SAMP effort to date and will also provide valuable information for directing changes to strategies and goals of the SAMP.

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Progress Report

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Executive Summary



Pea Patch Island, located in the Delaware River, is home to the largest colony of nesting herons on the East Coast (north of Florida) and is considered a wildlife resource of both local and national significance due to its size and persistence. Ten species of herons, egrets and ibises nest on this island each spring, numbering over 12,000 nesting pairs in the late 1980's. Today, the colony supports only about 3,000 nesting pairs of wading birds, and reproductive success for some species is low. The rapid decline in population has been cause for much concern among researchers, environmental organizations and private citizens and has warranted special attention for this resource through a Special Area Management Plan (SAMP).

The Pea Patch Island Heronry Region Special Area Management Plan (SAMP) was published in July 1998. The purpose of the SAMP was to outline a broad, ecosystem based approach to protecting and improving the resources that support the Pea Patch Island Heronry, to build knowledge about the heronry, and to ensure the commitments necessary for its long-term protection. The development of the SAMP was a consensus-based effort involving representatives from federal, state and local government agencies, nonprofit organizations and industry.

Key issues affecting the heronry were identified and characterized by SAMP participants at several workshops. Seven issue categories emerged as important to the herons of Pea Patch Island:

- Habitat Change and Development;
- Pesticides;
- Contaminants;
- Oil Spills and Industrial Accidents;
- Habitat Improvement and Protection;
- Human Disturbance; and
- Outreach and Education.

For each of these issue categories, a number of corresponding strategies were developed that target individual aspects of each issue. These issues and strategies are included in the *Pea Patch Island Heronry Region Special Area Management Plan Final Document* (1998). This document also provided guidance for efforts to implement and monitor priority strategies for improving or protecting the heronry and its associated critical habitats.

A SAMP "Implementation Team" was established for the purpose of ensuring that the strategies outlined in the Special Area Management Plan are effectively carried out. The SAMP Implementation Team has been meeting on a regular basis since 1997 and decides which strategies to fund with federal start-up money on an annual basis, works to find alternative sources of funding for strategies, and promotes cooperation between diverse agencies. This working group is comprised of persons from federal, state and local agencies, businesses, not-for-profit organizations and private citizens from both Delaware and New Jersey. As of 2001,

nearly two-thirds of the strategies outlined in the SAMP document have been implemented or addressed.

The purpose of this *Progress Report* is to comprehensively update the status of each SAMP strategy, provide information on important changes that have occurred in the region and to outline the policies of the Pea Patch Island Heronry Region Special Area Management Plan.

This *Progress Report* will be the basis upon which strategies and goals of the Pea Patch Island Heronry Region Special Area Management Plan will be evaluated and modified. A number of important changes have occurred in the Heronry Area since the completion of the original Plan, including stricter local land-use policies, improved mechanisms for land preservation, and a larger public awareness of environmental issues including water quality and wildlife conservation. These changes may render some strategies or issue categories obsolete or may warrant the development of additional issue categories and/or strategies.

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Introduction



Pea Patch Island, located in the Delaware River, is home to the largest colony of nesting herons on the East Coast (north of Florida) and is considered a wildlife resource of both local and national significance due to its size and persistence. A decline in the heronry population spurred the creation of a Special Area Management Plan (SAMP) for the region surrounding the heronry. The SAMP process brought many stakeholders together to work towards the goal of protecting the heronry and the resources upon which it depends. This section will briefly outline reasons for and development of the SAMP for the Pea Patch Island Heronry Region.

The Pea Patch Island Heronry and Surrounding Region

Pea Patch Island is located in the upper reaches of the Delaware Estuary, near highly industrialized and heavily populated areas of New Jersey, Delaware and Pennsylvania (see Figure 1 for location map). This 310-acre island is also home to Fort Delaware, a Civil War fort that is open to the public and sponsors numerous activities throughout the spring and summer. The Delaware River main shipping channel lies just 200 meters from the small island's eastern shore. The adjacent mainland of Delaware and New Jersey, which nesting herons depend upon for adequate and safe sources of food, is fringed by tidal and man-made impounded wetlands, surrounded by agricultural, industrial, petrochemical, and suburban land uses. Crucial foraging areas for many species of herons are currently threatened by the effects of explosive urban and suburban growth. Other anthropogenic stressors such as wetland loss and degradation, pesticide usage and industrial contamination, coupled with issues of nestling and egg predation, pose complex challenges to the survival of the thousands of herons, egrets and ibises that nest and rear their young on Pea Patch Island each year.

Ten species of long-legged wading birds inhabit Pea Patch Island (see below). The declining population of several species that nest on Pea Patch Island is indicative of the many challenges these birds face. The heronry is located in a large, multiple-use estuary, flanked by extensive areas of agriculture, residential and commercial development. This type of setting increases the chances of exposure to many pollutant classes including petroleum derivatives, industrial pollutants (PCBs, radionuclides), metals, pesticides, and municipal waste. The physical proximity of industrial infrastructure and commercial ship traffic to the island also poses a very real threat to the herons in the form of oil spills and accidental chemical releases. In addition, land-use changes (i.e. urbanization) can directly or indirectly impact areas available to herons for foraging either

Pea Patch Island Heronry Wading Bird Species

- | | |
|-----------------------------|------------------------------|
| • Great Blue Heron | • Little Blue Heron |
| • Great Egret | • Snowy Egret |
| • Cattle Egret | • Glossy Ibis |
| • Black-Crowned Night Heron | • Yellow-Crowned Night Heron |
| • Tri-Colored Heron | • Green Heron |

through direct losses of habitat or through secondary impacts of non-point source pollution, habitat degradation and human disturbance.

In 1993, a joint effort between Manomet Center for Conservation Sciences and the Delaware Department of Natural Resources and Environmental Control was undertaken to determine population status, contamination levels and habitat utilization of the Pea Patch Island herons in order to determine the issues affecting the heronry and critical needs for its survival. In addition to the background information this research provides, assessing the health of apex species (species at the top of a food chain, such as herons) provides a picture of the total health of an estuary ecosystem, including water quality status and viability of multi-tiered food webs.

Population status has been tracked carefully each year since 1993, and population surveys are also available from the 1970's and 1980's. In the mid-1980's more than 12,000 pairs of herons in total nested on Pea Patch Island. That number today is only about 3,000 pairs. This represents a significant drop in population numbers in only a few years, most notably in two species: Cattle Egrets and Snowy Egrets. Little Blue Herons are also showing population declines. Populations of other birds nesting on the island are either fairly stable or cycling. Egg production and nestling fledgling success for Pea Patch Island herons is generally lower than for most other wading bird colonies on the East Coast, but for all species studied, the most important factor in nestling mortality was predation by resident crows, owls and small mammals (Parsons et al. 2000d).

The proximity of industrial facilities to the heronry suggests that industrial contaminants (such as organochlorine and heavy metals) could be affecting the health of the heronry. However, these substances were only found at low to moderate levels of concern in certain species (Rattner et al. 2000, Matz et al. 2000, Burger et al. 1992), indicating that industrial contaminants are unlikely to pose a direct threat to reproductive success. However, it is important to note that low-level exposure to these contaminants could, in combination with other stressors, contribute to unstable population levels (Rattner et al., 2000).

Researchers have provided evidence that several species nesting on Pea Patch Island are exposed to low levels of anti-cholinesterase insecticides in regional foraging habitats. Blood cholinesterase levels in some heron species were found to be lower than those on other colonies on the East Coast; an indication that herons on Pea Patch Island could be experiencing primary or secondary exposures to organophosphate and carbamate pesticides (Parsons et al. 2000a). Cholinesterase is an enzyme required for nerve-to-nerve and nerve-to-muscle transmissions; hence, depressed levels of cholinesterase can result in behavioral changes. For example, a number of Cattle Egret nestlings were found to have moderate to severe lesions on their abdomens, caused by dermestid beetle larvae (commonly found in heron nests) feeding on their blood. It was hypothesized that the development of lesions was a direct result of changed behaviors from lowered cholinesterase levels; more specifically, that lowered blood cholinesterase was causing the nestlings to be lethargic, resulting in an inability to prevent the beetle larvae from opportunistically feeding on them.

15 km Study Area Locator Map Pea Patch Island Heronry Region

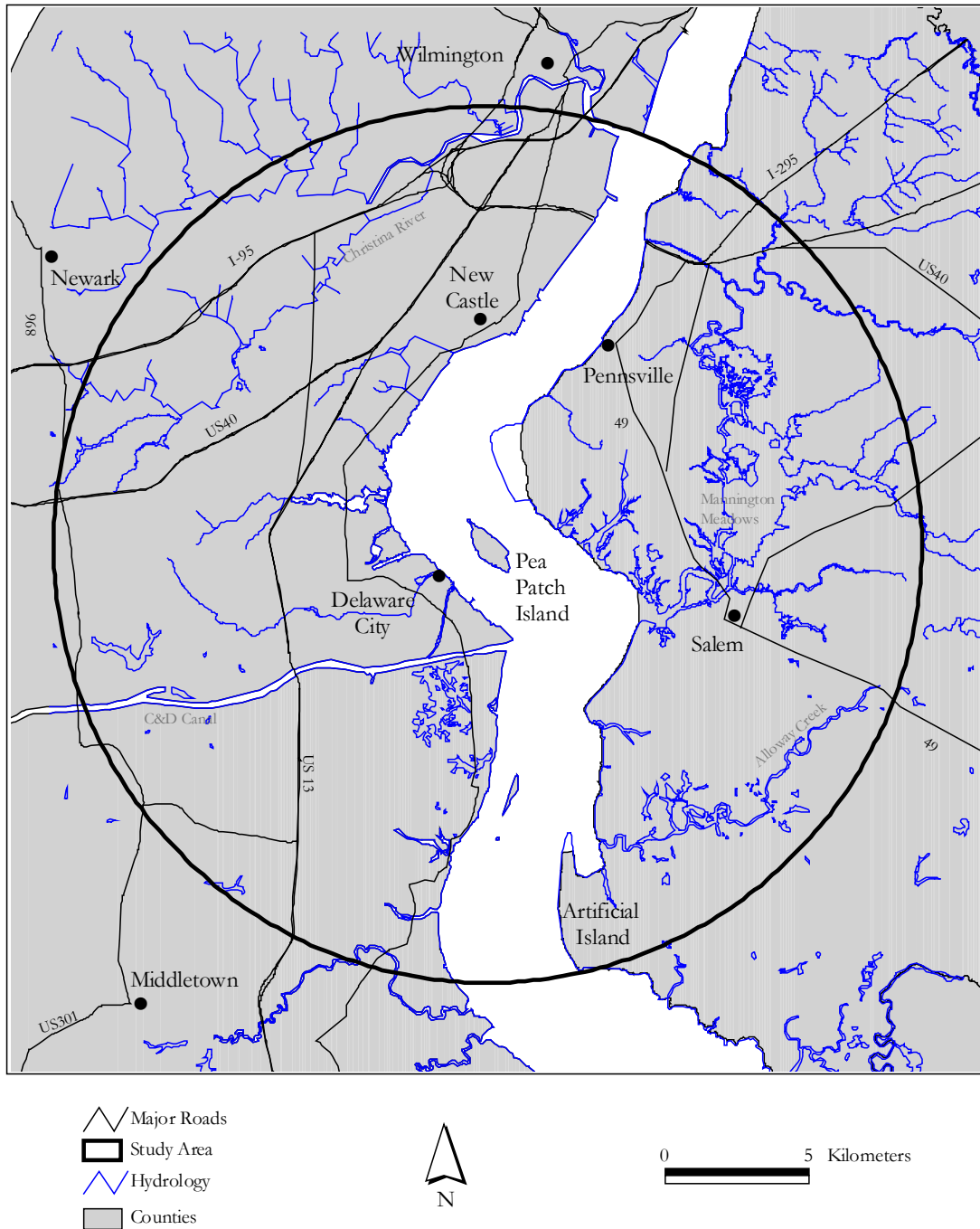


Figure 1. The Pea Patch Island Heronry Region Special Area Management Plan covers a geographical area that extends 15 kilometers out from the center of the Island. The 15-kilometer radius was chosen because it includes the primary foraging areas in Delaware and New Jersey that the birds of Pea Patch Island utilize.

In Cattle Egrets, low cholinesterase is known to be associated with reduced fledging success (Parsons et al. 2000c). All species nesting on the island are impacted by predators to a greater extent than would be expected given the size of the predator population on the island. Low cholinesterase is known to result in greater vulnerability to predators in some species (Galindo et al. 1985, Buerger et al. 1991).

Reasons for population fluctuations and reproductive success can vary among species and between years due to weather, predation and other factors. For example, Snowy Egrets show signs of inadequate or poor quality food resources (high starvation rates and endoparasitism) during some breeding seasons, but not others. Due to the complexity of the ecosystem in the Heronry Region, it is unlikely that a single factor accounts for most reproductive failure and population fluctuation in any species. It is for these reasons that a wide-ranging, multi-issue Special Area Management Plan was developed for the Pea Patch Island Heronry Region.

The Special Area Management Plan

Section 309 of the Federal Coastal Zone Management Act provides for Coastal Zone Enhancement Grants to states for the purpose of carrying out the section's specific objectives. One of the eight objectives defined in this section is "preparing and implementing special area management plans for important coastal areas." The statute defines a special area management plan as "a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone" (16 U.S.C.A. §1453(17)).

The Special Area Management Plan for the Pea Patch Island region was cultivated by the Delaware Coastal Management Program and National Oceanic and Atmospheric Administration's Strategic Environmental Assessment Division. This effort was driven by a large concern for the survivability of the Pea Patch Island Heronry and by the need to make proactive decisions regarding the management and protection of the resources which sustain the heronry. A Core Group of participants was formed to actively oversee the development of the Special Area Management Plan in 1996. In addition, two large workshops were held in which the Core Group and many additional stakeholders identified issues they believed to be affecting the sustainability and health of the heronry.

Seven major issues of concern were identified through the SAMP workshop process:

- Habitat Change/Development;
- Pesticides;
- Contaminants;
- Oil Spills/Industrial Accidents;
- Habitat Improvement and Protection;
- Outreach and Education; and
- Human Disturbance.

Each issue was thoroughly researched by participating persons and published as the *Pea Patch Island Heronry Region Special Area Management Plan: Issues Characterizations* (1997), a document which provides in-depth background information regarding the herons of Pea Patch Island, their surrounding environment and pertinent laws and policies. This information was used by workshop participants to develop targeted strategies to improve and protect the Heronry Region for each issue category. Each strategy is broken down into two or more specific “activities” or steps. Sixty-six strategies (with hundreds of activities) were drafted by the group; 28 strategies and their associated activities were selected for inclusion in the 1998 *Pea Patch Island Heronry Region Special Area Management Plan* (a list of all strategies originally identified at these workshops is available in Appendix B).

The goals of the Pea Patch Island Heronry Region Special Area Management Plan are to:

- Provide a framework for making coastal resource management decisions that will ensure the long-term protection of the heronry and the natural resources that support it without harming the economy of the region;
- Develop a series of policies and the necessary agreements required to implement these policies for the heronry region;
- Develop a broad ecosystem approach for addressing regional resource management issues;
- Use existing information, facilitate cooperation among stakeholders, recognize and integrate existing management efforts, and provide incentives for implementation of proposed management strategies.

The 28 selected strategies and the above goals form the basis of the Special Area Management Plan for the Pea Patch Island Heronry and have driven its implementation to date.

SAMP Implementation



A Core Group of participants has been meeting on a quarterly basis since 1997 to guide development of the final SAMP document and to oversee implementation of SAMP strategies. The group is now known as the Implementation Team. Since its inception, the Implementation Team has implemented 21 of the 28 strategies outlined in the final SAMP document, however each of these strategies is in varying stages of completion and each has had varying degrees of success. Please see Appendix A for a complete list of strategies and implementation progress. This section will briefly outline the role and objectives of the Implementation Team, and implementation of strategies.

The mission of the Implementation Team is to provide a framework for continuous regional coordination, communication, planning, funding and strategy implementation among federal, state and local agencies, and public and private groups that are addressing the goals of the SAMP. Recognizing the importance of the heronry as a unique natural resource, the role of the Implementation Team is to ensure that the survivability of the heronry and the regional ecosystem that supports it is an on-going priority for the public and all participating groups and jurisdictions.

The specific objectives of the Implementation Team are to:

1. Provide a forum for information sharing, discussion, and to generate public support for the Pea Patch Island Heronry Region SAMP:
 - Serve as a conduit to agencies, academia, public and private constituent groups to discuss and promote SAMP strategies, exchange information and comments, garner support and target resources for implementation;
 - Support existing and proposed collaborative efforts, communication and education with key target audiences such as local governments, local residents, businesses, industry, and agriculture on SAMP issues;
 - Continue to support the SAMP's community-based local and regional emphasis;
 - Provide a central forum to raise public and private interests and issues related to strategy implementation for discussion, evaluation and facilitation of resolution with responsible agencies and groups;
 - Ensure the commitment of political/governmental bodies and decision-makers to SAMP goals and strategy implementation.
2. Coordinate the implementation of SAMP strategies:
 - Facilitate and coordinate the implementation of the selected strategies;
 - Review the status of SAMP implementation and developing new or refine existing strategies to address identified concerns;
 - Ensure that all stakeholder interests are represented during strategy implementation;

- Evaluate and prioritize new issues as they arise, and coordinate development and implementation of strategies to address them.
3. Identify and recruit the staff and funding resources necessary to support the implementation of SAMP strategies and the Implementation Team's operations:
 - Develop annual funding and multi-agency staffing priorities for implementation;
 - Identify and recruit staff and funding resources for all strategies, including pooling of in-kind services from multiple agencies;
 - Investigate potential revisions of traditional agency approaches and staff allocations that would help facilitate a coordinated regional approach;
 - Identify and prioritize opportunities for collaborative grant proposals for SAMP strategies, develop an annual timeline for grant submissions, and jointly identify appropriate participants;
 - Coordinate development of collaborative grant proposals among federal, state and local agencies, nonprofit organizations and academia for SAMP strategies and related efforts.
 4. Improve integration among existing programs and projects related to SAMP efforts:
 - Identify and foster approaches to pooling the resources of various agencies, public and private groups to more efficiently address issues, including pooling of expertise, funding, staffing, information, etc;
 - Identify and develop means to carry out SAMP goals and strategies through modification or strengthening of existing programs and projects;
 - Foster communication and joint efforts with other Advisory Groups and committees related to the SAMP region including the Delaware River Basin Advisory Group and the Delaware Estuary Program;
 - Consolidate and reduce duplication among meetings, workshops and committees related to SAMP issues;
 - Provide a forum for early communication among agencies to exchange information on local projects and permit issues as they arise, to reduce delays and conflicting agency reviews/requirements.
 5. Establish a process for regular monitoring of progress toward SAMP goals:
 - Evaluate progress towards implementation of the strategies, and annually prioritize implementation tasks for each strategy;
 - Identify barriers to strategy implementation, and develop methods to remove them;
 - Evaluate the success of implemented strategies;
 - Recommend and carry out modifications for those strategies that are not successful.

For each of the past three years, the Implementation Team has cooperatively decided upon strategies to implement with dedicated funding from the National Oceanic and Atmospheric Administration (NOAA) for that year. Preference for strategy implementation is based upon

level of organization involvement in the SAMP, interest, and availability of matching funds. To date, of 28 strategies included in the original document, 21 have been implemented. Each of these strategies is currently in varying degrees of completion and each has achieved varying degrees of success (see Appendix A for a matrix of strategies and implementation progress or the Strategy Progress section for detailed progress reports).

Strategies implemented and funded by the Implementation Team include small-scale projects as well as complex, multi-organization efforts. Some projects were funded directly by the Implementation Team; other strategies were initiated independently by cooperating agencies or by using other funding sources. Examples of strategies initiated to date include: ensuring that a county comprehensive plan included riparian buffer ordinances, developing riparian buffer criteria, establishing a permanent buoy anchor system for oil spill booms around Pea Patch Island, and developing hazing and retrieval plans for Pea Patch Island and the surrounding area in the event of an oil spill or chemical release. Research on population, foraging habits, habitat and reproductive success of each of the ten species on Pea Patch Island is an integral part of many strategies and has been on going since 1993. The implementation of a number of strategies is dependent upon results of research because completion of research tasks is a prerequisite. In addition, results of various research projects may help to redirect SAMP implementation efforts in the future.

For the purpose of this document, a strategy is considered to be “implemented” if one or more of the listed activities for the strategy is underway or complete. Only a few of the strategies initiated by the SAMP Implementation Team have been completed in total, due largely to the complex and multi-faceted nature of many of the strategies. The following is a list of SAMP strategies where one or more activities is underway or completed:

Habitat Change and Development

HD-2: Develop a Land Preservation Tool Box

HD-3: Establish a Means to Recognize Property Owners and Developers that Help Preserve Natural Habitats

HD-4: Develop Criteria for Determining Riparian Buffer Area Overlays

HD-5: Incorporate Buffer Plans into the New Castle County Comprehensive Plan

Pesticides

PE-2: Determine Pesticide Use by Land Use

Contaminants

C-1: Evaluate and Assess Impacts of Confined Disposal Sites within the 15-km Foraging Area

C-2: Establish and Implement Sediment and Water Quality Criteria for Avian Species

C-3: Establish a Consistent Framework and Information Management System for Dredging Decision-Making

C-4: Target Pollution Prevention at Industries that Release Contaminants of Concern

C-5: Assess Effects of Industrial Contaminants and Pesticides on Wading Birds

Oil Spills and Industrial Accidents

- OS-4: Ensure that Salem River Response is Effective
- OS-5: Establish Permanent Anchor Points for Booming
- OS-6: Hold Spill Drills for all Sensitive Areas
- OS-7: Incorporate Hazing, Retrieval, and Transfer Plans into Wildlife Response Protocol

Habitat Improvement and Protection

- HI-1: Secure Landowner Cooperation or Land Access/Control for Wetlands Restoration Projects
- HI-2: Reduce Phragmites and Other Invasive Species
- HI-3: Review Existing Restoration and Wildlife Plans for PPI Needs and Benefits
- HI-4: Regenerate and Perpetuate Nesting Habitat on Pea Patch Island
- HI-5: Develop Site Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection

Human Disturbance

- HU-1: Managing Human Disturbance within PPI Heronry

Outreach and Education

- OE-1: Communication/Outreach that Creates a Greater Awareness of the Heronry

SAMP Policies and Goals



The ultimate goal for the Special Area Management Plan is to protect the heronry and the natural resources that support it. In addition to the cooperative efforts that the SAMP Implementation Team has spearheaded, policy mechanisms for protection of the resource are needed. The most readily available tool to protect the heronry is Federal Consistency, a process by which states, through approved coastal zone management programs, oversee federal activities occurring within their coastal zone. However, Federal Consistency is only enforceable through existing county and state authorities.

Federal Consistency

The Delaware Coastal Management Program (DCMP), the agency that instituted the development of the SAMP, is located within the Delaware Department of Natural Resources and Environmental Control's Division of Soil And Water Conservation. The DCMP is a state program created pursuant to the Federal Coastal Zone Management Act of 1972 (CZMA). The CZMA provided guidance and funding towards the creation of state coastal management programs in order to ensure protection of the nation's coastal resources. The DCMP and its program document were approved by the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management (NOAA/OCRM) in 1979. The DCMP's program document is a comprehensive set of both enforceable and unenforceable goals and policies based upon state environmental laws and regulations, including executive orders.

The development of SAMPs for important coastal areas is an integral part of coastal zone management. Policies that are developed as part of the Pea Patch Island Heronry Region SAMP will be included in the DCMP's program document. This inclusion into the program document is important because these policies will become part of the DCMP's review process for federal consistency.

Federal consistency is a provision of §307 of the CZMA that gives state coastal management programs the authority to evaluate and ensure that federal activities, permits, plans and monies which may affect the coastal zone's land, water, and natural resources are "consistent to the maximum extent practicable" with the coastal management program's policies. All applicants for federal permits and licenses must receive federal consistency certification from the DCMP (including wetland permits from the U.S. Army Corps of Engineers). All federal projects in the state must receive federal consistency before construction begins, and any project using federal monies must also receive federal consistency certification from the DCMP. Clearly, including policies aimed at protecting and preserving the Pea Patch Island Heronry in the DCMP's program document can provide some protections for the Heronry through state review of projects that could have impact to the heronry region. However, unless the policies included within the program document have associated legislation to enforce them, the policies are largely just recommendations.

Delaware's Endangered Species Law

Two Pea Patch Island species are currently on the Delaware State endangered species list: Black-crowned Night Heron and Yellow-crowned Night Heron. The Delaware Division of Fish and Wildlife has the authority to maintain a list of species of concern within the state. All federally listed species that occur within the borders of Delaware are automatically placed on the state list.

The Delaware Endangered Species Law does not include a specific takings prohibition, but does prohibit possession of listed species. The law does not include any requirements for agency consultation, development of recovery plans or designations of critical habitat (Environmental Law Institute 1999) for listed species; thus specific protection mechanisms for state listed threatened and endangered species are weak.

SAMP Goals and Policies

The following goals and policies will be included in the program document of the Delaware Coastal Management Program for use in Federal Consistency reviews. It is also hoped that additional protection mechanisms at the state and local level will be developed using these policies and goals as a basis.

The goals of the Pea Patch Island Heronry Region Special Area Management Plan are as follows:

1. To provide a framework for making coastal resource management decisions that will ensure the long-term protection of the heronry and the natural resources that support it without harming the economy of the region.
2. To develop a series of policies and the necessary agreements required to implement these policies for the heronry region.
3. To develop a broad ecosystem approach for addressing regional resource management issues.
4. To use existing information, facilitate cooperation among stakeholders, recognize and integrate existing management efforts, and provide incentives for implementation of proposed management strategies.

The policies of the Pea Patch Island Heronry Region Special Area Management Plan are as follows:

1. Land use planning that results in the preservation of quantity and quality of a variety of habitats necessary for heron survival and viability should be encouraged within the Heronry Region.
2. Suitable foraging and nesting habitats within the Heronry Region should be protected, restored, enhanced, created and/or managed for wading birds as well as other species of the Delaware Estuary.
3. Sources of potential wading bird exposure to chemical contaminants including pesticides, heavy metals and organochlorine compounds should be minimized to the maximum extent possible within the Heronry Region.
4. Adequate oil spill and industrial accident response mechanisms should be in place for the purpose of protecting Pea Patch Island itself and nearby wildlife resource areas. Prevention mechanisms for oil spills and industrial accidents should be used to the maximum extent practicable.
5. Human disturbances to the nesting colony of wading birds should be minimized.
6. Outreach and education regarding the heronry is important for public support of legislative actions and should be encouraged and supported by the SAMP Implementation Team.
7. The health of the wading bird nesting colony should be monitored and appropriate actions should be taken if problems with the colony are observed.

Current Status of the Heronry



The purpose of this section is to briefly discuss the current status of the Pea Patch Island Heronry, including population trends for each species. The information presented has been presented to and reviewed by the SAMP Research and Biomonitoring Group, a group composed of regional and national subject matter experts. More detailed information about foraging ecology, population trends and contaminant issues can be obtained from the publications and reports provided in the References section.

The SAMP Research and Biomonitoring Group

The SAMP strives to develop a strong scientific foundation upon which to base sound decision-making and policy formation. To that effect, a Research and Biomonitoring Group, composed of regional and national subject matter experts, was formed in 1997. The goal of this group is to guide the direction and focus of research conducted in coordination with the SAMP. The Research and Biomonitoring Group has met three times since 1997 to review and discuss current research efforts, to guide research and to identify research needs.

Wading Bird Foraging Ecology

Research has been conducted since 1993 to identify and evaluate foraging habitats critical to the persistence of wading birds in Delaware Bay. Foraging studies are on going and will document long-term trends in habitat selection since the mid-70s. At a landscape scale, Pea Patch Island's wading birds make use of a wide array of habitats in New Castle County, Delaware and Salem County, New Jersey (see Appendix C for a summary of species specific preferential habitats). Some species, such as Great Blue Herons and Glossy Ibises, exhibit great flexibility in site selection. Other species such as Great Egrets and Little Blue Herons feed primarily in wetland habitats in New Jersey. Cattle Egrets forage primarily west of the Island (Delaware and Maryland) and Snowy Egrets typically favor wetlands south of the island (Parsons 1996b).

In addition to general habitat studies, more focused studies have examined the impact of impoundment management on wading bird foraging (Parsons 1996, Parsons 1997) and the selection of agricultural habitats by Cattle Egrets (Schmidt and Parsons 2000b).

Population Trends

Population trends on Pea Patch Island are currently obtained using several methods that minimize adverse effects to the birds, including ground-based nest counts, counts of attending adults, flightline observations and aerial surveys. Estimates of the number of nests in the Phragmites marsh are obtained using nest transect surveys, adult density estimates and aerial photography.

Long-term population trends on Pea Patch Island are difficult to determine, despite the existence of population estimates from the 1970's and 1980's. The estimates from the 1970's and 1980's

were developed from line transects through only the upland portion of the heronry – no quantitative estimates of birds nesting in the Phragmites were attempted. Correlating early sets of data with data collected using current methodologies is difficult, and accurate comparisons cannot be made (Parsons 2000).

Analysis of data collected since 1993 shows that total abundance on Pea Patch Island has dropped 75% (See Figure 1). Cattle Egret abundance has dropped 66% in the same period, numerically driving the overall reduction in population. Other species whose populations declined significantly include Little Blue Heron and Snowy Egret. Populations of Great Blue Herons and Black-crowned Night Herons remained relatively constant over the same period. However, Great Egrets added approximately 90 nests per year until recent years. This species now accounts for 20% of the total nesting population on the island. Populations of Glossy Ibis on the island are believed to be cycling. In 1998, the colony's total population was estimated to be 3139 pairs of birds (Parsons 2000). No total population count was conducted in 1999, but preliminary estimates from 2000 indicate that the overall population of wading birds on the island increased slightly since 1998.

**Total Wading Bird Population (Nest Pairs) at Pea Patch Island
1993-2000**

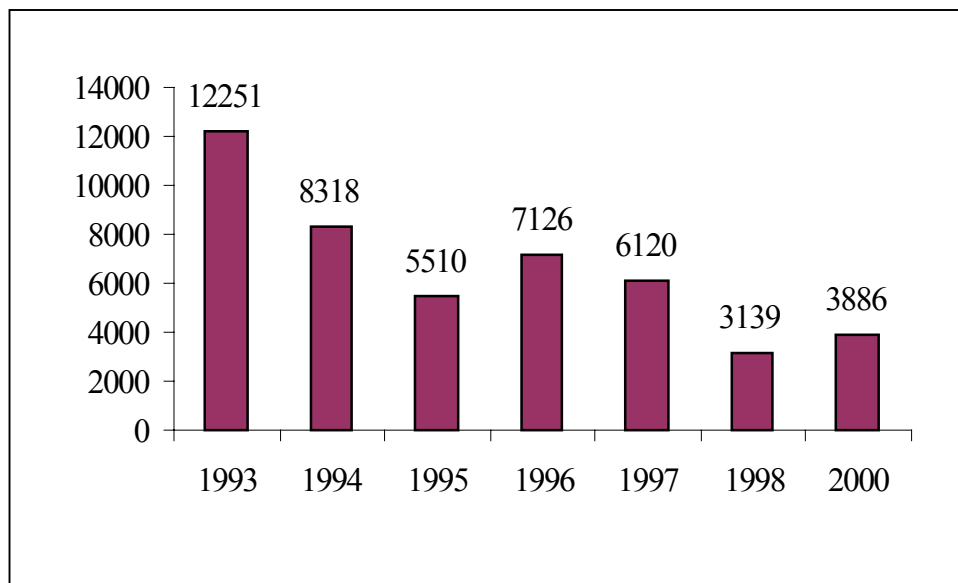


Figure 2.

A population of 15+ pairs of Yellow-crowned Night Herons has begun to nest in the woods 100 yards north of the Fort Delaware maintenance shed, remote from the main colony on the island. This population accounted for more than half of their population on Pea Patch Island in 1998 (Parsons 2000). This “satellite colony” of Yellow-crowned Night Herons will be monitored closely in the upcoming years.

Nest Productivity

Wading bird productivity at Pea Patch Island varies among species (Parsons 1995, Parsons 1996). Great Blue Herons and Little Blue Herons consistently produce numbers of fledglings comparable to sustainable rates reported in the literature (Rodgers 1980, Butler 1992). Hatching success of Black-crowned Night-Heron, Snowy Egret, and Glossy Ibis is low in Delaware Bay compared to other sites studied (Parsons et al. 2000d). Nestling survival is very low at Pea Patch Island compared to other sites for all species studied (Parsons et al. 2000d). For all species studied, the most important factor of nestling mortality is predation. Predation accounts for more nestling loss at Pea Patch Island than at most other sites studied (Parsons et al. 2000d).

Organochlorines and Metals

Research projects since 1993 have been conducted to quantify exposure and effects of several pollutant classes to some wading bird species utilizing Delaware Bay. Examinations of industrial contaminants (organochlorines and metals) have focused on wetland generalists such as Black-crowned Night Herons and Great Blue Herons. This research documented impacts of only low to moderate concern for organochlorines (Parsons and McColpin 1995, Rattner et al. 2000, Matz et al. 2000) and metals (Burger et al. 1992, Parsons 1996, Rattner et al. 2000). A number of strategies for the SAMP were aimed at reducing availability of industrial contaminants; this research shows that exposure to industrial contaminants may not factor heavily into the declining health and population in wading birds at Pea Patch Island.

Anti-Cholinesterase Pesticides

Research has been conducted regarding exposure and effects of anti-cholinesterase compounds (organophosphate and carbamate pesticides) in wading birds on Pea Patch Island and on other urban and non-urban heronries on the East Coast. As part of a regional project, Manomet determined that serum cholinesterase is depressed in some species nesting in Delaware Bay as compared to other east coast estuaries, especially urban locations (Parsons et al. 2000a). In addition, the occurrence of abdominal lesions on nestlings at non-urban heronries were documented (four of five species at Pea Patch Island) (Parsons et al. 1998) and were linked to depressed cholinesterase levels in two of three species tested, including Cattle Egrets, on Pea Patch Island (Parsons et al. 1998). Pesticide exposure studies have focused on the Cattle Egret, a terrestrial foraging species commonly found in agricultural habitats (crop fields, poultry houses, livestock yards) (Schmidt and Parsons 2000b). Wetland heron species are implicated in pesticide exposure scenarios as a result of lesion occurrence and depressed cholinesterase in species utilizing agricultural wetlands (cranberry bogs) at other sites. However in Delaware Bay, symptoms associated with depressed cholinesterase are less severe in wetland species than in species utilizing upland habitats (Parsons et al. 1998).

**Great Blue Heron Population (Nest Pairs)
Pea Patch Island 1993-2000**

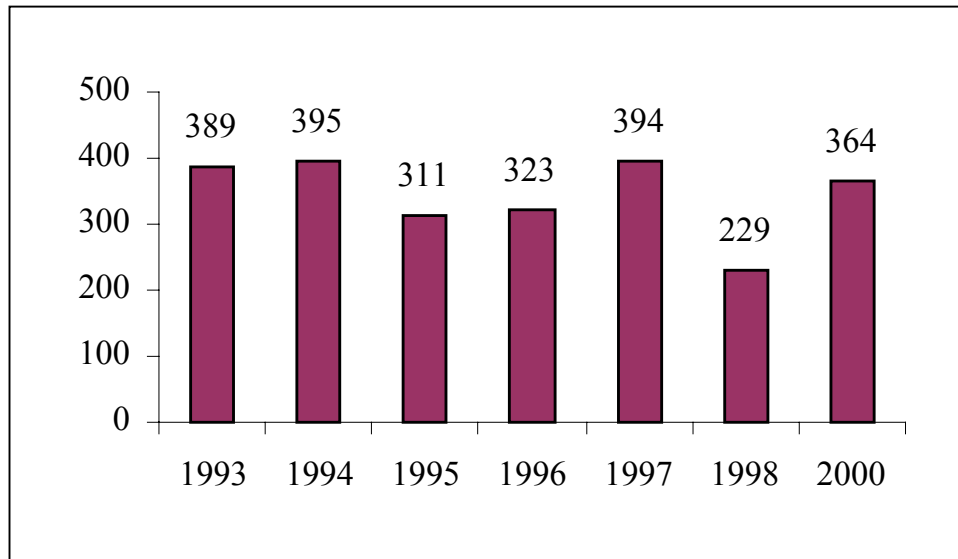


Figure 3.

**Great Egret Population (Nest Pairs)
Pea Patch Island 1993-2000**

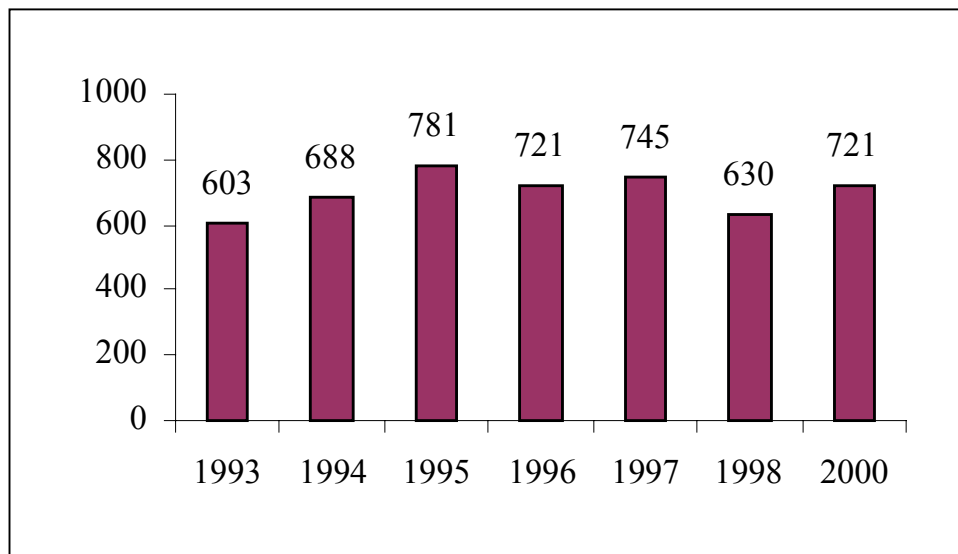


Figure 4.

**Snowy Egret Population (Nest Pairs)
Pea Patch Island 1993-2000**

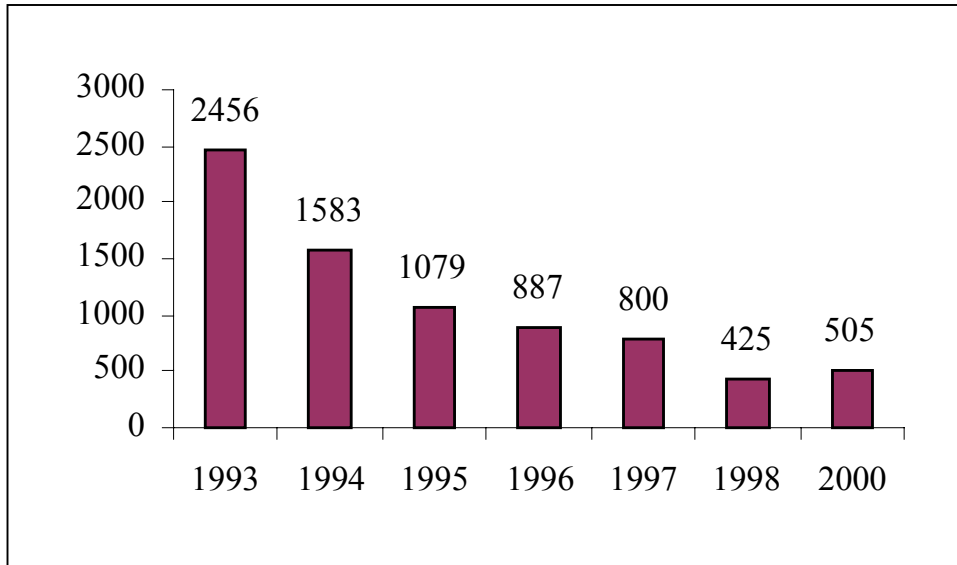


Figure 5.

**Little Blue Heron Population (Nest Pairs)
Pea Patch Island 1993-2000**

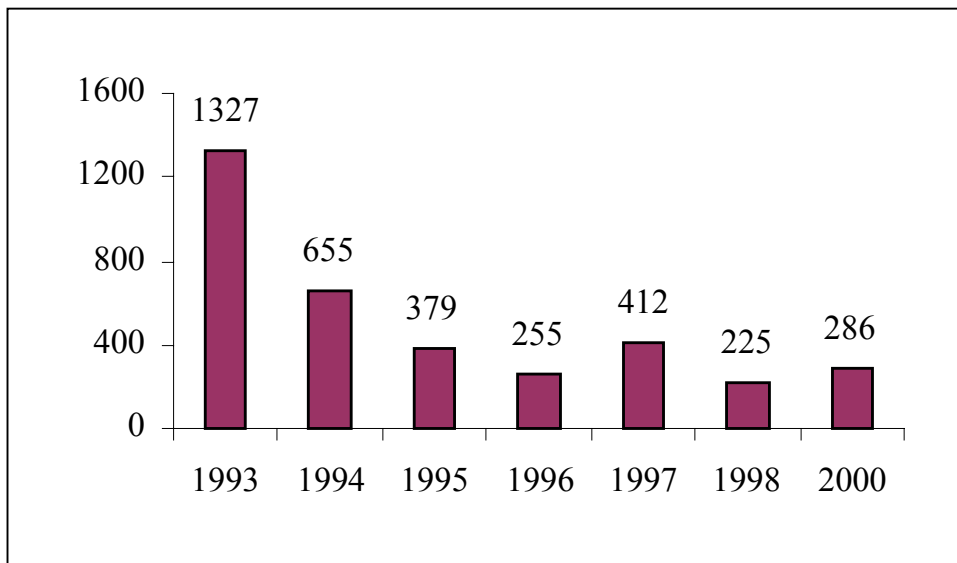


Figure 6.

**Cattle Egret Population (Nest Pairs)
Pea Patch Island 1993-2000**

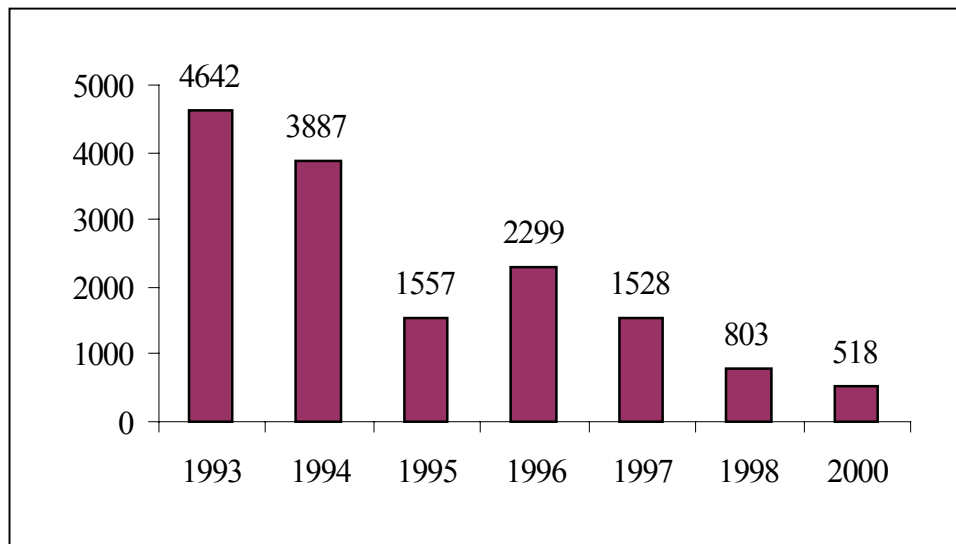


Figure 7.

**Glossy Ibis Population (Nest Pairs)
Pea Patch Island 1993-2000**

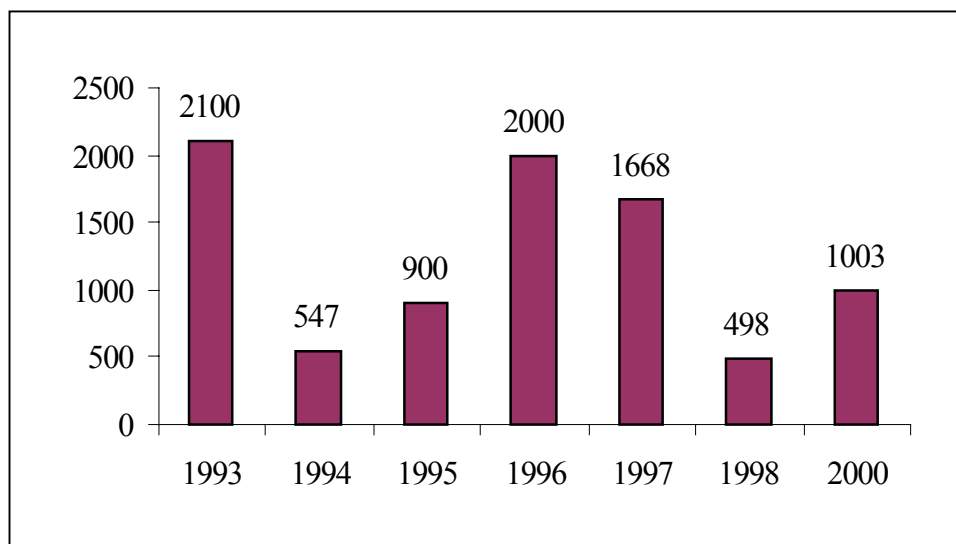


Figure 8.

**Black-Crowned Night Heron Population (Nest Pairs)
Pea Patch Island 1993-2000**

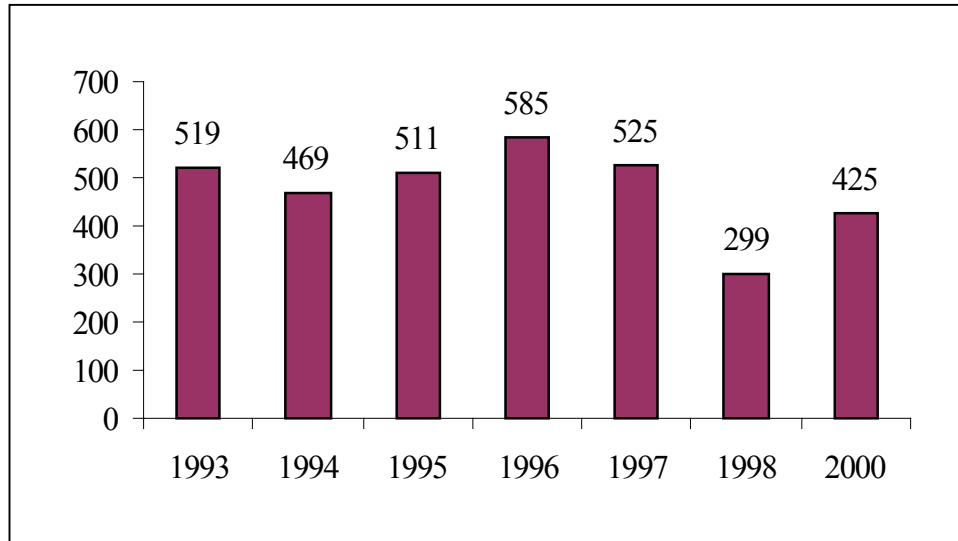


Figure 9.

**Yellow-Crowned Night Heron Population (Nest Pairs)
Pea Patch Island 1993-2000**

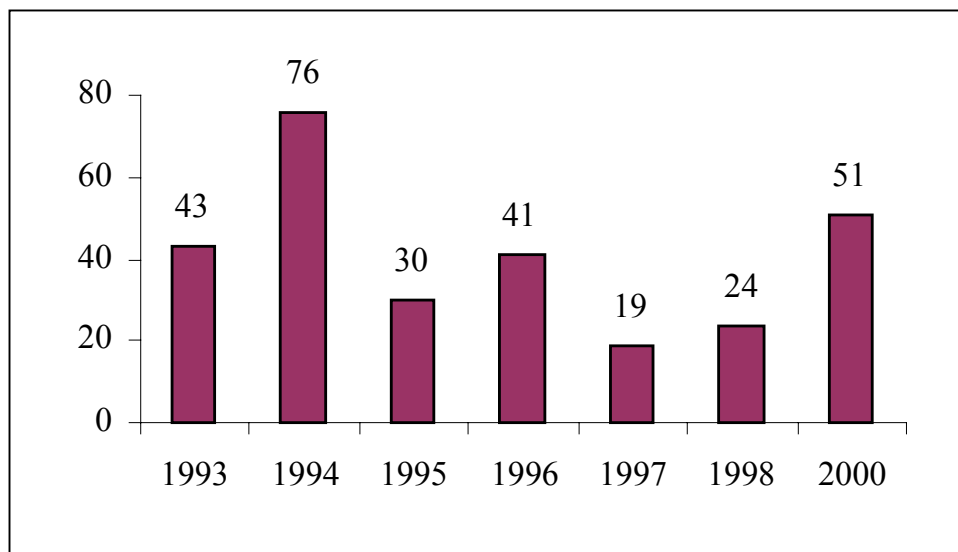


Figure 10.

Manomet investigated potential explanatory factors for cholinesterase inhibition including age, immune status, nutritional status, anti-cholinesterase industrial contaminants (mercury), and anti-cholinesterase pesticides (organophosphates, carbamates) (Parsons et al. 1998, Parsons et al. 2000a). The variability in cholinesterase levels were not a result of age, immune status, nutritional status or exposure to mercury. Pesticides were implicated as a cause of depressed cholinesterase by reactivation analysis (Parsons et al. 2000a), organophosphate residue detections in a preliminary examination of nestling regurgitations (Parsons et al. 1998), and foot wash samples from adult Cattle Egrets (Parsons et al. 2000b). However, organophosphate residues were not detected in regurgitations in a study performed by the Delaware Department of Agriculture (G. Stayton, pers. comm.). Organophosphates detected in foot wash samples (naled, phorate) were not analyzed in this Department of Agriculture study. Further residue analysis is pending with researchers at Southern Illinois University that may provide further valuable information about the role that exposure to organophosphate compounds may play in depressed cholinesterase levels in wading birds.

Manomet further investigated cholinesterase depression by raising a captive population of Cattle Egrets in cooperation with Tri-State Bird Rescue and Research. Both adults and nestlings from captive collections show elevated cholinesterase compared to wild cohorts (Parsons et al. 2000b) despite high variability inherent in serum cholinesterase assays.

An ongoing area of study is determining ecological endpoints associated with depressed cholinesterase and lesion development. Cholinesterase deficits have been documented to result in adverse impacts to thermoregulation, food consumption and predator-avoidance (Grue et al. 1997). Lesion severity and cholinesterase recorded for individual nestlings did not explain nestling survival in most heronries studied, however in one heavily lesioned population in Massachusetts, cholinesterase was positively correlated with survival (Parsons et al. 1998). Low cholinesterase (but not lesion occurrence) in Cattle Egret nestlings on Pea Patch Island was associated with low fledging (Parsons et al. 2000c).

Abdominal Lesions

Abdominal lesions have been documented to occur on several species of nestlings on Pea Patch Island, especially Cattle Egrets. Lesions can be caused when dermestid beetle larvae (which are common inhabitants of nests) feed opportunistically on nestlings. Research has focused on the hypothesis that lowered cholinesterase levels cause behavioral changes (such as lethargy, inattentiveness and neurologically impaired muscles) that inhibit a nestlings' ability to rid themselves of the pest.

Manomet investigated potential explanatory factors for lesion development including nest parasite abundance and immunological status (Parsons et al. 1998). While dermestid beetles (Schmidt and Parsons 2000a) inhabiting heron nests are strongly implicated as the source of lesions, abundance of beetles does not predict lesion development. The largest beetle concentrations in nests are found in urban estuaries where abdominal lesions are absent (Parsons et al. 1998). In a study on Pea Patch Island, abdominal lesions were prevented from occurring when nest parasites were excluded from the nest. Blood cholinesterase levels in Cattle Egrets

were sampled during this exclusion study; preliminary results indicate that low cholinesterase levels facilitate lesion development when dermestid beetle larvae are present in the nest (Schmidt and Parsons 2000a).

Recent Pesticide Restrictions

The U.S. Environmental Protection Agency (EPA) is currently reviewing the allowable limits (tolerances) for pesticide residues in food as mandated by the Food Quality Protection Act of 1996. This Act directed the EPA to review all pesticide uses with an added margin of safety for children's developing physiology. By August 2006, the EPA is scheduled to have completed a review of all allowable pesticide limits that were in effect in August 1996. Organophosphate pesticides are in the first priority group for this EPA review and a number of new restrictions have been implemented for certain pesticides in this class due to new information regarding tolerance limits.

In 1999, the EPA accepted voluntary cancellation of many food crop uses of methyl parathion, a highly toxic organophosphate, to reduce exposure risks to children. Cancelled uses include all fruits, carrots, succulent peas and beans, tomatoes, some cole crops (such as broccoli and cauliflower) and some leaf crops (such as lettuce and spinach). However, methyl parathion use is still permitted on corn, soybeans, alfalfa, wheat and a number of other crops (Environmental Protection Agency, 1999).

The EPA announced an agreement in December of 2000 to phase out the use of diazinon for indoor uses beginning March 2001 and for all lawn, garden and turf uses by December 2003. Diazinon, an organophosphate pesticide, is one of the most widely used pesticides for household lawn and pest control. Diazinon had the highest number of reported bird kill incidents of any registered pesticide during 1994-1998. These new restrictions will eliminate 75% of the current diazinon usage. The EPA also plans to restrict about one-third of the agricultural uses of diazinon. The remaining allowable crop uses of diazinon will maintain a Restricted Use Pesticide status and its use will be limited to trained, certified applicators (Environmental Protection Agency, 2001).

The EPA is also implementing restrictions for chlorpyrifos, an organophosphate pesticide sold under the brand names Dursban, Lorsban and others. Many of the agricultural restrictions center on usage for apples, tomatoes, and grapes. However the EPA is also phasing out all indoor and outdoor residential use of this pesticide, limiting use to trained applicators. Some public health uses and low-risk uses (areas where children are not likely to be exposed) are allowed to continue under the new regulations (Environmental Protection Agency, 2000).

New regulations and restricted use of certain organophosphate pesticides may reduce exposure pathways for herons. However, the true implications of these restrictions for the health of the Pea Patch Island Heronry are not well known at this time because pesticide usage throughout the region, particularly household use has not been formally assessed and many allowable uses for the organophosphate pesticides remain.

Current Status of the Region



This section addresses development, population growth and habitat changes in the Pea Patch Island Heronry Region including population data, land use changes and state and local policies for growth management. Detailed descriptions of the region and issue characterizations can be found in the Pea Patch Island Heronry Region Special Area Management Plan: Issue Characterizations, March 1997 and the Pea Patch Island Special Area Management Plan, July 1998.

The Pea Patch Island Heronry Region, the area within a 15-km radius of Pea Patch Island, encompasses a variety of habitats located within New Castle County, Delaware and Salem County, New Jersey. Although generally rural in character, the Heronry Region includes portions of the metropolitan areas surrounding Wilmington, Delaware, Camden, New Jersey and Philadelphia, Pennsylvania. Research done in conjunction with the Special Area Management Plan has shown that the original delineation of the Heronry Region may be inadequate because several species of herons frequently fly outside of the Region to forage. For example, Cattle Egrets are often found in horse pastures in Eastern Maryland and Snowy Egrets can be found foraging in the tidal marshes of central Delaware, near Bombay Hook National Wildlife Refuge. However, the original 15-km radius most likely captures the majority of critical foraging areas used by most species while feeding their young. The SAMP Implementation Team may decide to expand the boundaries of the Heronry Region based upon better species range information. The new Region might include all of New Castle County, Delaware, all of Salem County, New Jersey and portions of Kent County, Delaware and Cumberland County, New Jersey (see Figure 11). Because of this possibility, information regarding land use changes and population growth in Kent and Cumberland Counties is provided.

The Heronry Region's proximity to metropolitan areas and the resultant suburban sprawl, particularly in the southern portion of New Castle County, poses particular challenges for the health of the Pea Patch Island Heronry. The loss of agricultural land directly impacts species such as the Cattle Egret and the Glossy Ibis that utilize agricultural fields for foraging. Development and suburban sprawl can also have indirect impacts on wading birds by contributing to degradation of surrounding wetlands from increased sediment, nutrient and contaminant loads in point and non-point source pollution run-off.

The development and degradation of upland habitat are important factors in the long-term survival of the heronry. As mentioned above, some species are directly dependent upon upland habitat for food sources. The majority of the species on the island however, tend to forage in wetland habitats. The availability of a variety of high-quality, undisturbed wetland habitats in the Heronry Region is crucial for such a diverse heronry.

Population

The current population of Delaware is 783,600. The population of New Castle County is 500,265, an increase of 13.2% from the 1990 census (U.S. Census Bureau, 2000). Estimates from New Castle County predict that by 2020, its total population will reach 533,470. Southern

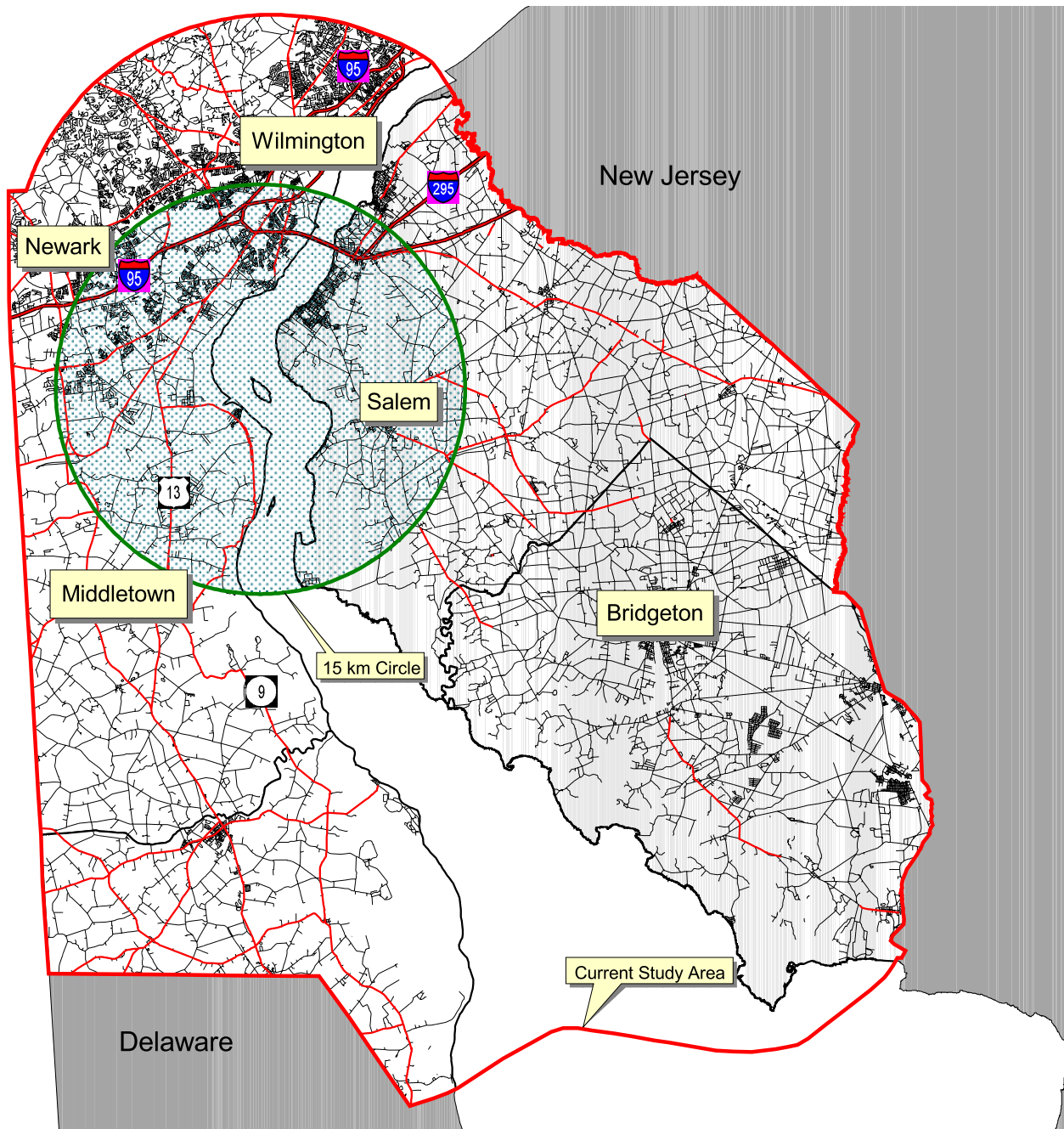


Figure 11. Comparison map of the original 15-k radius Heronry Region and an expanded Heronry Region. The original area encompasses an area of approximately 273 square miles, the expanded area shown above would encompass an area of approximately 1,500 square miles.

New Castle County (the portion of the county south of the Chesapeake and Delaware Canal) and portions of the Christiana, Bear and Glasgow regions in Northern New Castle County are experiencing high rates of population growth (and associated development pressures). In 1998, the population of Southern New Castle County was 25,368. This number is expected to increase by 90% to 48,217 by 2025 (WILMAPCO, 2000).

The current population of New Jersey is 8,414,350. The current population of Salem County is 64,285, a decrease of 1.5% from the 1990 census. The population of Cumberland County is 146,438, an increase of 6.1% from the 1990 census (U.S. Census Bureau, 2000). Projections obtained from the Salem County Planning Board estimate that the population of Salem County will grow by 24% from 1990 to 2025, a net increase of 15,830 persons. The population of Cumberland County is expected to increase by 28% over the same period with a net gain of 38,000 persons (M. Reeves, pers. comm.).

**Population Density Comparison
For Counties in and Proximate to the Pea Patch Island Heronry Region**

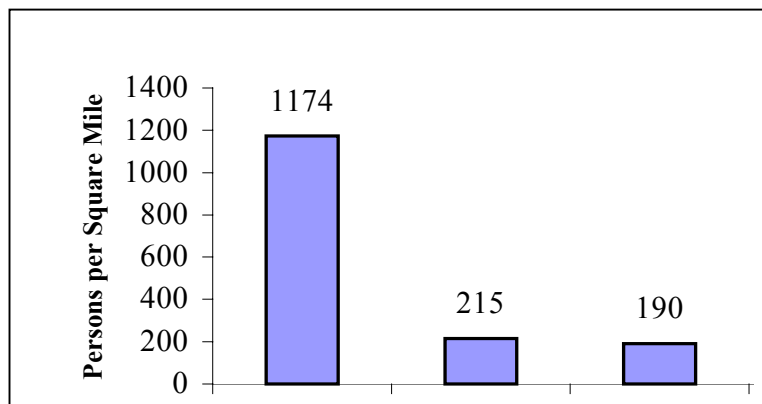


Figure 12.

Using the above numbers to calculate population density for each county clearly illustrates the differences between New Castle County and its neighboring counties of Salem, Cumberland and Kent (see Figure 12). Clearly, New Castle County is the most urbanized county in the Heronry Region and population predictions indicate that development pressure will be greatest here, especially in the largely undeveloped areas in Southern New Castle County.

Land Use/Land Cover Changes

A study conducted by the Delaware Office of State Planning Coordination using satellite imagery found that the overall land use trend in Delaware is towards increasing urbanization and decreasing agricultural and forest lands. Between 1992 and 1997, developed land cover (including residential, industrial, commercial etc.) increased by almost 14% (26,275 acres) in Delaware. During the same time period, the area of agricultural and forested land decreased almost 4% (-30,294 acres), and wetlands decreased by almost 1% (-2,354 acres) (Delaware Office of State Planning Coordination, 1999).

In New Castle County, residential/urban land uses showed an 8% (5,893 acres) increase over the 1992-1997 time period. Between the period of 1984 and 1992, residential/urban land uses had increased by 33%. In Kent County, residential/urban land uses increased by 21% (6,067 acres) between 1992 and 1997. The tables below summarize land use changes by acreage and percent distribution in New Castle and Kent Counties from 1992 – 1997.

Table 1 -- Summary of Land Use Changes in New Castle County, Delaware (1992-1997)

	1992		1997		Change	
	Acres	%Distr.	Acres	%Distr.	Acres	%Distr.
Residential/Urban	70,484.53	25.51%	76,378	27.64%	5,893.43	8.36%
Agricultural	84,904	30.72%	79,643	28.82%	-5,261	-6.20%
Forest	46,573	16.85%	43,889	15.88%	-2,684	-5.76%
Wetlands	32,036	11.59%	31,908	11.55%	-128	-0.40%

Source: Delaware Office of State Planning Coordination, 1999

Table 2 -- Summary of Land Use Changes in Kent County, Delaware (1992-1997)

	1992		1997		Change	
	Acres	%Distr.	Acres	%Distr.	Acres	%Distr.
Residential/Urban	28,643	7.48%	34,711	9.06%	6,068	21.18%
Agricultural	193,519	50.54%	187,152	48.87%	-6,366	-3.29%
Forest	39,625	10.35%	39,386	10.29%	-239	-0.60%
Wetlands	98,349	25.68%	97,603	25.49%	-746	-0.76%

Source: Delaware Office of State Planning Coordination, 1999

Land use information provided for Salem and Cumberland Counties is not based on aerial or satellite imagery, but on State Plan Areas and approved developments. Plan Areas are designated growth zones and indicate general land uses in counties in New Jersey. The table below shows the total area of each county and the percentage of land area in major categories of Plan Areas.

Table 3 -- State Plan Areas in Salem County and Cumberland County, New Jersey

	Total Area (sq. miles)	Metropolitan	Suburban	Fringe	Rural	Rural/ Env. Sensitive	Env. Sensitive
Cumberland County	489	7%	8%	<1%	26%	4%	40%
Salem County	338	3.8%	4.8%	2%	46%	22.4%	12.3%

Source: M. Reeves, pers. comm. and M. Pisarski, pers. comm.

Additional information obtained from the Salem County Planning Board indicates that in 2000, a total of 726 acres in Salem County were approved for minor subdivisions, 260 acres were approved for major subdivisions and 220 acres had approved site plans. Since 1990, the Salem

County Planning Board has approved 6,834 acres of subdivisions and 1,609 acres of site plans (Salem County Planning Board, 2000). The Townships of Pittsgrove, Pilesgrove and Alloway are “growth” municipalities in Salem County. Pittsgrove Township in particular is experiencing rapid “suburbanization.” These Municipalities and the County are currently engaged in planning efforts intended to channel new development into identified growth centers (M. Reeves, pers comm.).

**Acres of Approved Subdivisions and Site Plans in
Salem County, New Jersey (1990-2000)**

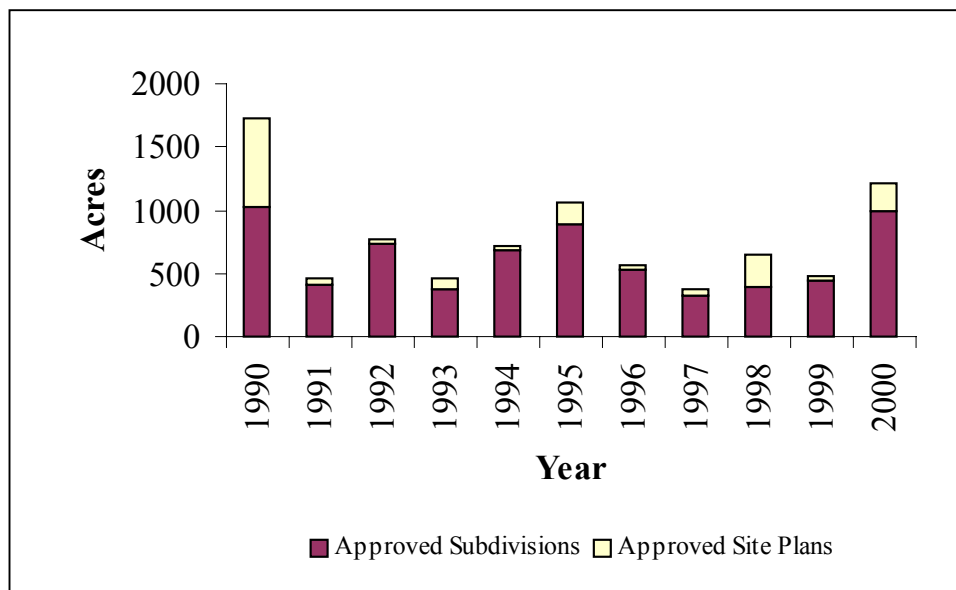


Figure 13.

Land Preservation Programs

Delaware’s Open Space Program coordinates state purchases of land for the purpose of preservation or recreational use. The Program protected over 13,175 acres between 1990 and 1996. The Program has designated twenty areas as “State Resource Areas” designated because of their tremendous natural and cultural resources. These areas encompass existing protected state, federal, local and private conservation organization lands and inholdings as well as areas targeted for purchase or protection. These state resources areas comprise over 250,000 acres, representing 19% of land in Delaware. Four of the State Resource Areas (SRA) are located in the Pea Patch Island Heronry Region: The Christiana River SRA, the Upper Delaware River SRA, the Chesapeake and Delaware Canal SRA and the Lower Delaware River SRA. The program is funded from land and water conservation bonds, portions of the realty transfer tax and legislative appropriations. These funds are used for acquisitions within SRA boundaries.

The Delaware Agricultural Lands Preservation Program seeks to preserve agricultural land through agreements and conservation easements. Landowners in the program agree to not develop their land for at least 10 years, using it for only agriculture and related uses. In return,

the owners receive tax benefits, right-to-farm protection, and an opportunity to sell a preservation easement to the state that will keep the land from ever being developed. There are now 122,572 acres in 469 Agricultural Preservation Districts and District expansions in Delaware. Out of the 122,572 acres currently in agricultural preservation districts, 152 properties encompassing approximately 53,783 acres have been permanently protected through the purchase of preservation easements. The total acreage of Agricultural Preservation Districts in New Castle County is 14,367 and 64,772 in Kent County. The total acreage of farms permanently protected by purchase of development rights is 6,407 in New Castle County and 30,125 in Kent County (Delaware Department of Agriculture, 2001).

New Jersey has a number of programs for land preservation and currently has 939,941 acres of designated open space. The New Jersey Green Acres Program, part of the New Jersey Department of Environmental Protection, was created in 1961 to meet New Jersey's growing recreation and conservation needs. The Green Acres program has spent over \$1.4 billion dollars to preserve 350,000 acres throughout the state. This program provides funding for land purchases two ways: the Municipal Incentive program and the Non-profit program. The Municipal Incentive Program provides low cost loans to municipal and county governments and the Non-profit program provides 50% matching grants to land trusts and other conservation groups. Municipalities can help non-profits obtain these funds by contributing to the 50% match.

The New Jersey Farmland Preservation Program was established in 1983 and has preserved a total of 69,375 acres of farmland. This includes 10,053 acres in Salem County and 6,177 acres in Cumberland County. These two programs are funded via a variety of sources, including but not limited to \$98 million a year in State sales tax revenue for 10 years and up to \$1 billion in bond sales over 10 years.

Growth Management Programs

The New Castle County Unified Development Code (UDC) was passed in December of 1997. It serves to update and enhance all County regulations regarding zoning, subdivision, natural resource protection, design, and provision of infrastructures. The UDC is administered by the Department of Land Use who conduct long-range land use planning and regulate individual development plans through the administration of zoning and subdivision regulations, review of plans, issuance of permits and inspection of construction sites. The UDC is especially important for the protection of the Heronry Region because it outlines new regulations for riparian buffer areas and open space, in addition to directing growth toward areas most suitable for it. The UDC can be viewed on the web at: http://www.rapidregs.com/czo/new-castle/brwsframe_j.asp

The Delaware Land Use Planning Act (LUPA), enacted in 1978 and amended in 1996, is intended to provide a complimentary mechanism for review of major land use planning actions through notice and comment processes at the State and local (county and municipal) levels. It is intended to facilitate coordination on major development proposals and provide an opportunity to have issues and concerns of an affected jurisdiction considered in the land use decision-making process. The Act specifies the types of projects that must be reviewed and commented on by involved agencies, but additional projects can be reviewed under this process as deemed by the

State Planning Coordinator. Additional information about this program can be found at <http://www.state.de.us/planning/lupa>.

In March 2001, Delaware Governor Ruth Ann Minner signed Executive Order 14, establishing a “Livable Delaware” agenda. Livable Delaware is a comprehensive strategy to control sprawl and direct growth to areas where the state, county and local governments are most prepared for new development in terms of infrastructure and services. This new initiative will develop graduated impact fees for development occurring outside of a planned growth area, develop new annexation standards, strengthen the Land Use Planning Act and change the open space funding formula to increase the state’s ability to acquire and maintain protected land (Office of Delaware Governor 2001).

The Delaware Coastal Zone Act of 1971 prohibits new facilities of heavy industry and bulk production transfer from locating in the coastal strip of the Delaware coastline and subjects manufacturing uses to a permit to ensure protection of coastal resources. Although the Coastal Zone Act does not regulate commercial, residential, warehousing or distribution activities, it has been a pivotal force in preserving and protecting the wetlands from industrial development along the fringe of the Delaware River from development. Opportunities may arise in the future for habitat improvement projects in the Region from off-set requirements included in the new Coastal Zone Act regulations, adopted in May 1999.

The New Jersey Waterfront Development Law of 1914, the New Jersey Coastal Wetlands Act of 1970 and the New Jersey Coastal Area Facility Review Act of 1973 (CAFRA) each grant authority to the New Jersey Department of Environmental Protection to regulate the location, design and construction of major residential, commercial and industrial developments in New Jersey’s Coastal Zone. The regulations under CAFRA affect a 1,376 square mile coastal region including portions of Cumberland and Salem counties. Amendments to CAFRA in 1993 expanded the scope of project review to include the impacts of minor “developments” in regulated coastal areas. The amendments also required development of an environmental inventory of the coast and long-term environmental strategies. Recent proposed changes to CAFRA regulations would funnel all coastal growth into cities and towns, and away from ecologically sensitive areas.

The New Jersey State Development and Redevelopment Plan (State Plan) was adopted by a unanimous vote of the 17-member State Planning Commission in 1992 and revised in 2001. In addition, the New Jersey Municipal Land Use Law provides the framework for all 566 municipalities in New Jersey to implement their own local planning and zoning regulations. The purpose of the State Plan is to achieve all state planning goals by coordination public and private actions to guide future growth into compact forms of development and redevelopment. It also seeks to ensure that development is located where it makes the most efficient use of existing and planned infrastructure and where it is within the capacities of infrastructural, environmental, natural resource, fiscal and economic resources. The State Plan established statewide policies for: Equity, Comprehensive Planning, Resource Planning and Management, Public Investment Priorities, Infrastructure Investments, Economic Development, Urban Revitalization, Housing, Transportation, Historic, Cultural and Scenic Resources, Air Resources, Water Resources, Open

Lands and Natural Systems, Energy Resources, Waste Management, Agriculture, and Areas of Critical State Concern.

Protected Land

A study conducted as a part of the Pea Patch Island Heronry Region SAMP, identified and characterized parcels of protected land in the expanded Heronry Region. These parcels were then analyzed as to suitability for potential heron nesting and foraging habitat. The region studied encompassed an area of approximately 1,500 square miles and included all of New Castle County, the northern half of Kent County to the southern portion of Bombay Hook National Wildlife Refuge, all of Salem County and the western half of Cumberland County to Egg Island Point. The results of the study showed that in this region, there are 770 individual protected parcels of land in the region, owned and managed by 58 different entities (Ratsep Group, 2000). The total acreage of this land is 161,005 acres.

The number and acreage of protected areas in the Heronry Region surpassed what was originally thought to exist. Many of these areas are small recreational areas (e.g. baseball and soccer fields) owned by communities or municipalities and provide little in the way of habitat value for herons. However, the remainder provides important wetland and upland areas critical for heron foraging activities. Figure 15 illustrates protected and managed areas in the expanded Heronry Region, showing extensive areas of protected land along the coasts of Delaware and New Jersey. The number of acres of protected land in this region is indicative of the great strides that have occurred in land preservation over the past two decades and bode well for the well being of the heronry. It is hoped that continued studies will better characterize the quantity and quality of habitats required to sustain the heronry.

Expanded Heronry Region



Figure 14.

Protected and Managed Lands in the PPI Heronry Region

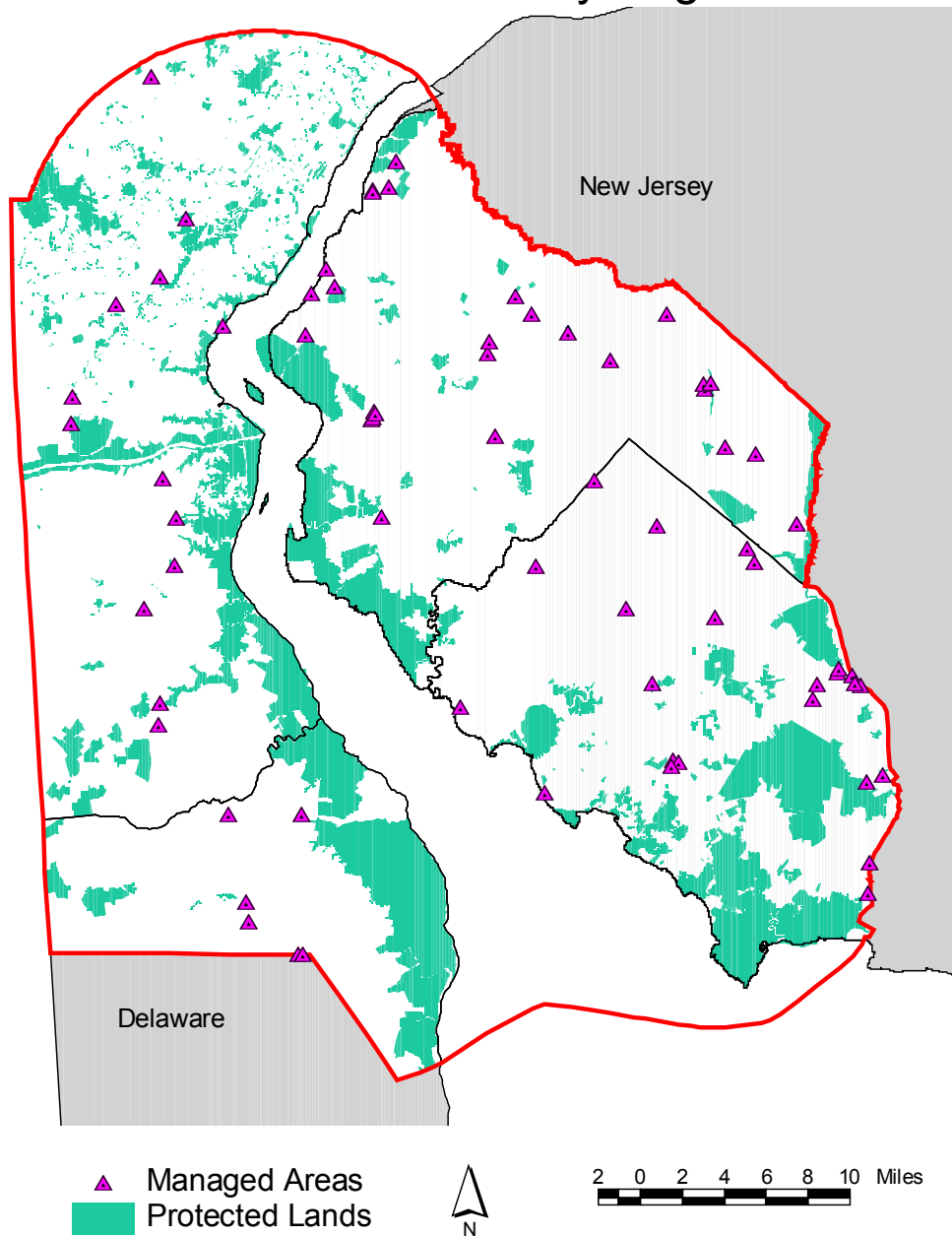


Figure 15. Protected and managed areas within an expanded Pea Patch Island Heronry Region.

Strategy Progress: Contaminants



Great strides have been made in our understanding of the health and habitat of the birds on Pea Patch Island due to the efforts of scientists at Manomet Center for Conservation Sciences, Patuxent Wildlife Research Center, Texas Tech University, Tufts University and Tri-State Bird Rescue and Research. Research conducted to quantify contaminant loads and physiological effects of contaminants and pesticides has been conducted since 1995. Final analysis of the data is currently underway and when complete, should give resource managers a better indication of priority contaminant problems in the Heronry Region. This information will be used to help target priorities for future SAMP strategies.

In addition to contaminant research, a dredging policy framework for the State of Delaware was completed which will help coordinate agency review of dredging projects and thus, minimize dredging impacts (including contaminant availability). Wading bird utilization of confined dredged material disposal sites was also analyzed as part of SAMP implementation.

The following pages provide detailed strategy progress reports for each strategy in the Contaminants issue category of the SAMP. Each strategy report summarizes the intended purpose of the strategy, the original activities associated with the strategy and progress to date. Related non-SAMP activities and potential future direction were discussed when information was available.

C-1

Evaluate and Assess Impacts of Confined Disposal Sites Within the 15 km Foraging Area

Purpose:

The goal of this strategy is to evaluate the operation and maintenance of confined disposal facilities and their potential for release and containment of contaminated material, to determine wading bird usage at these facilities and to determine any associated exposure impacts.

Activities: (checked strategies have been implemented)

- ✓ 1. Determine usage and benefits of confined disposal facilities for avian species.
- ✓ 2. Define the operation and maintenance of confined disposal facilities within the 15-km radius.
- ✓ 3. Assess impacts and identify options for minimum contaminant exposure.
- 4. Implementation and monitoring.

Progress:

Manomet Center for Conservation Sciences led efforts to determine the usage of benefits of confined disposal facilities for avian species. Collection of field data documenting waterbird use of confined disposal facilities occurred in 1994, 1995, 1996 and 2000. Three disposal sites in the Pea Patch Island Heronry Region were monitored: Killcohook, Augustine Management Area and Everglades.

Analyses of the 1994-95 data can be found in Parsons 1996 (*Significant wetlands of upper Delaware Bay: Habitat status and relationship to the Pea Patch Island wading bird colony*). Comprehensive analysis of all data is currently underway. Environmental samples (sediment) were collected at Killcohook in 2000 and results from screening analyses for organochlorine and metal contaminants are expected in 2001.

Existing data on waterbird usage of confined disposal facilities suggests that these areas provide important but transient foraging opportunities for waterbirds.

Related Activities:

Versar, Inc. conducted a study for the Army Corps of Engineers (USACE) regarding habitat conditions at ten confined disposal areas in Delaware and Maryland. The purpose of the study, entitled *Habitat Evaluation, Wetland Delineations, and Environmental Assessments of Ten Federal Upland Disposal Areas Along the Chesapeake and Delaware Canal, Cecil County, Maryland and New Castle County, Delaware (March 1998)*, was to provide USACE with habitat evaluations and sensitive habitat maps to enable them to make better decisions regarding future placement of dredged materials. The final report includes wetland delineations, documentation

of wildlife and their habitats, plant and animal species of concern and maps of vegetation and land cover. Four of the confined disposal facilities described in this report are within the Pea Patch Island Heronry Region.

Future Direction:

The current evaluation of usage and impacts is based on one year of monitoring data (2000) for a confined disposal facility. As a preliminary examination this is sufficient, however if contaminants data suggest that confined disposal areas may pose risk of physiologically significant levels of exposure to organochlorine and metal contaminants, more investigation may be warranted. Existing data on usage suggest that confined disposal areas provide important but transient foraging opportunities for waterbirds.

C-2

Establish and Implement Sediment and Water Quality Criteria for Avian Species

Purpose:

The purpose of this strategy is to establish appropriate criteria for sediment and water quality for the protection of avian life. The criteria will be based upon data and results regarding contamination effects levels in wading birds in the Delaware estuary.

Activities: (checked strategies have been implemented)

- ✓ 1. Identify levels of contamination for prey items at various trophic levels.
- 2. Identify data gaps for various trophic levels and obtain data.
- 3. Identify sources of available information and determine sampling strategies to address gaps for site specific data and conduct sampling.
- 4. Develop a bioaccumulation model to describe trophic transfer of contaminants.
- 5. Establish appropriate criteria based upon bioaccumulation model results.

Progress:

In 1995, Manomet Center for Conservation Sciences examined organochlorine and metal contaminants in fish samples collected both above and below water control structures at Red Lion Creek, Thousand Acre Marsh and Augustine Creek. A summary of the data can be found in Parsons 1996 (*Significant wetlands of upper Delaware Bay: Habitat status and relationship to the Pea Patch Island wading bird colony*).

In addition to work conducted by Manomet, benthic ecology and sediment samples were collected in the Delaware River and Bay by the National Oceanic and Atmospheric Administration (NOAA) in cooperation with the Delaware Coastal Management Program in the fall of 1997 as part of NOAA's Status and Trends Program. A number of samples were taken proximate to Pea Patch Island. The report from this work is still in draft form, but a final report should be available in 2001.

C-3

Establish a Consistent Interstate Framework and Information Management System for Dredging Decision-Making

Purpose:

The purpose of this strategy is to improve the review process for dredging projects by drafting a dredging policy framework and by creating a desktop information management system for comprehensive reviews. The original scope of this work has been reduced to include Delaware only, with the expectation that coordination with New Jersey and Pennsylvania will occur after initial project completion.

Activities: (checked strategies have been implemented)

- ✓ 1. Conduct workshop on existing dredging policy framework.
- ✓ 2. Revise and implement the dredging policy framework.
- ✓ 3. Conduct a second workshop to address problems associated with informational needs.
- 4. Develop a supporting information management system.

Progress:

A dredging working group was established for the purpose of guiding development of the dredging policy framework. The group included a number of stakeholders from state and federal governments, private businesses, not for profit organizations and public citizens. This group, and associated focus groups, met about ten times over a two-year project period. In addition, a large strategy workshop was held in December of 1999.

The *Issues Characterizations* document was published in October 1999. The Working Group identified dredging issues and categories and provided supporting information. This document also contains background information about dredging in general, existing regulations and guidance from federal and state agencies. The information contained within the *Issues Characterizations* provided the basis for the development of the Dredging Policy Framework.

The Statewide Dredging Policy Framework was published in February 2001. The goals of the Framework were to:

- Provide clear guidance and early coordination between regulatory agencies and applicants;
- Evaluate project justifications based upon economic and environmental impacts;
- Identify preferred dredging methods and disposal options, including beneficial uses;
- Provide a consistent approach to testing and monitoring activities; and
- Provide education and public outreach regarding dredging activities in State waters.

The Statewide Dredging Policy Framework will be used by permitting agencies and applicants to improve decisions made during the application process. It will also be the basis for the subsequent information management system.

Products:

Issue Characterizations (October 1999)

Statewide Dredging Policy Framework (February 2001)

Related Activities:

New Jersey implemented a similar initiative in 1997 and published *The Management and Regulations of Dredging Activities and Dredged Material in New Jersey's Tidal Waters*. The purpose of this effort was to make the permitting process for dredging activities and the management of dredged material less complicated and more efficient.

Future Direction:

The ultimate goal of this strategy is to coordinate efforts to improve dredging reviews and management in the states of Delaware, Pennsylvania and New Jersey. Federally sponsored Regional Dredging Teams have been established in other areas of the United States for the purpose of coordinating and prioritizing dredging projects at an interstate level and great success has been had in the Great Lakes Region (see the Great Lakes Dredging Team web site at www.glc.org/projects/dredging for more information). The Regional Dredging Team structure may be the best method for achieving regional coordination.

C-4

Target Pollution Prevention at Industries that Release Contaminants of Concern

Purpose:

The purpose of this strategy is to supplement existing regulatory efforts to reduce discharges of contaminants of concern in the Pea Patch Island Heronry Region by providing technical assistance to businesses and industries.

Activities: (checked strategies have been implemented)

- ✓ 1. Identify contaminants of concern.
- ✓ 2. Identify industries and businesses that release contaminants of concern.
- 3. Contact industries and businesses to offer technical assistance.
- 4. Implement technical assistance.

Progress:

Research projects since 1993 have been undertaken to quantify exposure and effects of several pollutant classes to some wading bird species utilizing Delaware Bay. Examinations of industrial contaminants (organochlorines and metals) have focused on wetland generalist species such as Black-crowned Night Herons and Great Blue Herons. Impacts of low to moderate concern have been documented for organochlorines (Parsons and McColpin 1995, Rattner et al. 2000, Matz et al. 2000) and metals (Burger et al. 1992, Parsons 1996, Rattner et al. 2000).

Future Direction:

Because industrial contaminants have been shown to have low impacts and be of less immediate concern than insecticide exposure, a modified strategy might include developing collaborative monitoring and management pilot projects with agencies and organizations influencing pesticide use in the region. Collaborations could identify habitats and specific chemicals representing potential hazard to wildlife and develop best management practices to minimize non-target impacts.

C-5

Assess Effects of Industrial Contaminants and Pesticides on Wading Birds

Purpose:

This purpose of this strategy is to assess the significance of exposure of wading birds to contaminants and pesticides. This strategy will establish the relationship (both correlative and causal) between exposure and effects (or lack of). A broad spectrum of effects will be assessed including biochemical, physiological, immunological, reproductive, and population level responses.

Activities: (checked strategies have been implemented)

- ✓ 1. Quantify contaminant exposure.
- ✓ 2. Monitor birds for exposure effect (biochemical to population level responses).
- ✓ 3. Establish links between exposure and effects through statistical analysis.
- 4. Establish causality through controlled laboratory studies.
- 5. Develop, implement and monitor success of management actions (as needed).

Progress:

Research projects since 1993 have been undertaken to quantify exposure and effects of several pollutant classes to some wading bird species utilizing Delaware Bay. Examinations of industrial contaminants (organochlorines and metals) have focused on wetland generalist species such as Black-crowned Night Herons and Great Blue Herons. Impacts of low to moderate concern have been documented for organochlorines (Parsons and McColpin 1995, Rattner et al. 2000, Matz et al. 2000) and metals (Burger et al. 1992, Parsons 1996, Rattner et al. 2000).

In addition to industrial pollutants, Manomet has investigated the exposure and effects of anti-cholinesterase compounds in wading birds since 1993. As part of a regional project, Manomet determined that serum cholinesterase is depressed in some species nesting in Delaware Bay, as compared to other east coast estuaries, especially urban locations (Parsons et al. 2000a). Potential explanatory factors for cholinesterase inhibition (including age, immune status, nutritional status, anti-cholinesterase industrial contaminants (mercury), and anti-cholinesterase pesticides (organophosphates, carbamates) were examined as part of this study (Parsons et al. 1998, Parsons et al. 2000a). Cholinesterase variability was not explained by developmental effects, white blood cell counts, mass/size indices, or exposure to mercury. Pesticides were implicated by reactivation analysis (Parsons et al. 2000a), organophosphate residue detections in a preliminary examination of nestling regurgitations (Parsons et al. 1998), and foot wash samples from adult Cattle Egrets (Parsons et al. 2000b). However, organophosphate residues were not detected in regurgitations in a study performed by the Delaware Department of Agriculture (G. Stayton, pers. comm.). Organophosphates detected in foot wash samples (naled, phorate) were not analyzed in this Department of Agriculture study. Further residue analysis is pending with

researchers at Southern Illinois University that may provide further valuable information about the role that exposure to organophosphate compounds may play in depressed cholinesterase levels in wading birds.

An ongoing area of study is determining ecological endpoints associated with depressed cholinesterase and lesion development. Cholinesterase deficits have been documented to result in adverse impacts to thermoregulation, food consumption and predator-avoidance (Grue et al. 1997). Lesion severity and cholinesterase recorded for individual nestlings did not explain nestling survival in most heronries studied, however in one heavily lesioned population, cholinesterase was positively correlated with survival (Parsons et al. 1998). Low cholinesterase (but not lesion occurrence) in Cattle Egret nestlings on Pea Patch Island was associated with low fledging (Parsons et al. 2000c).

C-6

Prioritize Hazardous Waste Sites for Clean-up According to Wading Bird Usage

Purpose:

The goal of this strategy is to develop a list of hazardous waste sites that contain contaminants of concern and are actively used by wading birds in the Heronry Region so that risks to these birds can be addressed in site remediation plans.

Activities:

1. Obtain the National Priority List (NPL), State, and Resource Conservation Recovery Act (RCRA) hazardous waste sites within the 15-km radius.
2. Identify sites with habitat risks and contaminants of concern.
3. Conduct literature search.
4. Determine projected clean-up schedule.
5. Finalize list.
6. Determine usage of sites by wading birds.
7. Rank/prioritize sites for clean up.

Progress:

The SAMP Implementation Team has not initiated this strategy.

Related Activities:

The State of Delaware has information regarding hazardous waste sites available on the web through an interactive mapping tool called the Environmental Navigator. The Environmental Navigator can be used to locate hazardous waste sites and research contamination histories. This tool is available at <http://sirb.awm.dnrec.state.de.us/enweb/> or can be linked to through DNREC's main web site, www.dnrec.state.de.us.

Future Direction:

The increasing availability of hazardous waste site information on the web and through shared GIS layers could aid the implementation of this strategy. However, research results regarding contaminant loads in wading birds and site utilization may indicate that wading birds rarely use known hazardous waste sites in the Heronry Region and that risks to birds through this exposure pathway are minimal.

Strategy Progress:

Habitat Change and Development



Most of the initiatives outlined in the Habitat Change and Development section have been implemented. The most notable is the passage of the New Castle County Unified Development Code, which includes strict riparian buffer ordinances. These ordinances will help preserve and protect wetland resources in the Heronry Region. In addition, regional evaluations of riparian buffers and development of a tool to aid site-specific design of buffers are underway. This may help improve habitats in the Region when used in conjunction with programs such as the USDA Conservation Reserve Program and the Conservation Reserve Enhancement Program.

The following pages provide detailed strategy progress reports for each strategy in the Habitat Change and Development issue category of the SAMP. Each strategy report summarizes the intended purpose of the strategy, the original activities associated with the strategy and progress to date. Related non-SAMP activities and potential future direction were discussed when information was available.

HD-1

Ensure Adequate Funding to Protect Habitat through Fee Simple Land Acquisition in the Heronry Region

Purpose:

The purpose of this strategy is to evaluate and prioritize all options for funding fee-simple acquisition of open space for the purpose of preserving those regions that are most important ecologically to the Heronry Region.

Activities:

1. Identify and evaluate all options for funding of fee simple acquisition of open space.
2. Prioritize options based on amount of funding available and duration of funding.
3. Build public & political support for priority options.

Progress:

The SAMP Implementation Team has not initiated this strategy, however open space preservation is on going in both Delaware and New Jersey. Public awareness of the need to preserve open space and habitat has increased greatly in recent years due to issues such as loss of habitat and suburban sprawl. This public perception has helped spur efforts in state and federal legislatures to increase funding for open space conservation.

The states of Delaware and New Jersey both have well established programs for the purchase of open space. Both states have also successfully acquired important habitat for wading birds and other wildlife within the Pea Patch Island Heronry Region. Delaware's Open Space Program and New Jersey's Green Acres Program have each been highly successful at permanently protecting critical habitats, primarily through fee simple acquisition.

Future Direction:

Funding for Open Space in Delaware appears to be dwindling and will likely enjoy less funding support in future years. This would likely elevate the priority ranking of this strategy.

HD-2

Develop a Land Preservation Tool Box

Purpose:

The purpose of this strategy is to develop land preservation “tool box” for landowners, developers, planners and persons interested in planning issues. The “tool box” will provide information on land preservation options available in Delaware and a list of land preservation programs within the state.

Activities: (checked strategies have been implemented)

1. Design and develop a how-to/quick reference printed guide.
- ✓ 2. Enhance and enlarge the existing State Planning web page.
3. Distribute guides through libraries and state and county planning offices.

Progress:

The Office of State Planning Coordination has enhanced and enlarged their web site <http://www.state.de.us/planning>. Information available on this site includes: listings of public meetings, legislative updates, information on zoning and proposed changes, publications and presentations and pertinent GIS layers.

The Office of State Planning Coordination will work with stakeholders, including the newly formed Biodiversity Committee, to have a land preservation “tool box” available on the web by Spring 2001.

HD-3

Establish a Means to Recognize Property Owners and Developers that help Preserve Natural Habitats

Purpose:

The goal of this strategy is to establish an annual award program that recognizes those persons or organizations that have contributed to making Delaware a better place to live by preserving natural habitats. The focus of the award will be good land use practices in development and renovation projects.

Activities: (checked strategies have been implemented)

- ✓ 1. Review Office of State Planning's efforts to establish an awards program.
- 2. Identify eligible property owners and developers who can be contacted when the awards program begins.
- 3. Advertise the awards program.

Progress:

The land use planning awards program has been transferred to the Delaware Chapter of the American Planning Association. This organization distributed awards in late 2000, but to date, no official category has been added that would satisfy the requirements of this strategy. The Office of State Planning Coordination is investigating the possibility of adding a land preservation/protection category.

Future Direction:

The award program should be advertised to gain distinction among developers and planners and a similar program could be set up in New Jersey.

HD-4

Develop Criteria for Determining Riparian Buffer Overlays

Purpose:

This strategy will develop site-specific design criteria (widths, vegetation types, etc) for buffers for all land uses and major local conditions in the Pea Patch Island Heronry Region. This will be done in a manner that will accommodate the multiple goals of water quality maintenance or improvement, wildlife habitat protection, bank stabilization, flood control, and erosion control.

Activities: (checked strategies have been implemented)

- ✓ 1. Identify the priority buffer zone objectives by land use.
- ✓ 2. Assess site conditions throughout the region.
- ✓ 3. Review literature and interview buffer zone “experts”.
- ✓ 4. Publish summary report.
- 5. Conduct a seminar of design criteria findings.
- 6. Determine program structure options for implementation of PPIHR buffer zone criteria.

Progress:

The HD-4 strategy has evolved from the identification of priority riparian buffer zones in the Pea Patch Island Heronry Region into the Riparian Buffer Initiative, the development of a GIS (Geographic Information System) application to address riparian issues within the entire state of Delaware. This application will have the ability to import data from the Pea Patch Island Heronry Region in New Jersey if/when New Jersey data becomes available.

Stakeholder workshops were held in 1999 and 2000 to identify priority goals. A summary report of these workshops is available online at <http://www.dnrec.state.de.us>. After priority goals were established, an analysis of environmental conditions and existing buffer science was conducted to establish specific riparian buffer design criteria for use in the GIS application.

Outreach and education activities are on going. A Riparian Buffer web site was established to disseminated information regarding the Riparian Buffer Initiative. It can be accessed at <http://www.dnrec.state.de.us>. In addition, 5,000 copies of a Riparian Buffer Initiative brochure were printed and 1,000 tote bags were produced for distribution at public events, conservation districts and appropriate conferences.

Design of the ArcView based GIS application for the Riparian Buffer Initiative is currently underway. The GIS application will consist of two separate but complimentary modules, the Planning Module and the Site Design Module. The Planning Module will allow the user to quickly identify riparian areas within a watershed that have or do not have vegetated buffers. The Planning Module will also allow a review of the connectivity between riparian areas and pre-established protected areas. The Site Design Module will allow the user to view a number of riparian buffers designs, at a parcel level, for comparison of area coverage and location. The

buffer design options will include state and federal cost-share program models, as well as buffers addressing DCMP's Riparian Buffer Initiative priority goals. A beta version of this GIS application is currently being refined.

Once the GIS application is in its final form, it will access all of the relevant data collected in this project, allow a user to choose and quickly create a buffer model for a specific site of interest on a regional or parcel level scale. The user can use the GIS application to easily compare and combine any number of buffer designs, each based on a priority goal, for improved buffer design decisions.

Related Activities:

- Delaware Department of Natural Resources and Environmental Control, Non Point Source Program has an Urban Buffer Pilot Program applied to the Christina Watershed. The goal of the pilot program is to establish urban buffer design criteria, incentives, and property eligibility requirements for future State of Delaware urban buffer initiatives.
- New Castle County Department of Land Use is developing a work plan for the Protection and Enhancement of Wetlands and Riparian Corridors in Southern New Castle County. The goal is to assist New Castle County in evaluating stormwater and urban sprawl as a major stressor of wetlands and streams.
- Ducks Unlimited, Chesapeake Bay Foundation, and the US Forest Service are working on a cooperative project that will develop a GIS-based Decision Support System for developing conservation programs and evaluating project efficiency/accomplishments in the Chesapeake Bay Watershed. This GIS application will help plan, target, and analyze their wetland, riparian, and upland restoration projects.
- Maryland Department of Natural Resources has developed similar applications, including:
 1. Riparian Forest Buffer Targeting: A GIS based targeting tool created to assist the MD DNR Forest Service in implementation of Stream ReLeaf.
 2. Wetland Restoration Targeting: A GIS based targeting tool created to assist various groups in targeting wetlands for restoration.
 3. Green Infrastructure Assessment: A GIS based landscape assessment of the most ecologically important lands remaining in Maryland. "Hubs" and "corridors" are identified.

Future Direction:

The Delaware Coastal Management Program will help integrate this tool into the county level Conservation Districts, where most riparian buffers are planned and implemented in Delaware. The system will allow the Conservation Districts to better coordinate their efforts with state and federal agencies based on a set of known priority buffer goals. Conservation District staff can use the GIS based buffer designs to negotiate the final buffer decision with local land owners and know that the tool provides scientifically justifiable designs capable of meeting the intended

goals of riparian buffers in Delaware. Training and support will be provided to the Conservation Districts by the Delaware Coastal Management Program.

Once the Delaware GIS system is up and running, information from New Jersey could be incorporated and the application could be applied to conservation efforts in the New Jersey portion of the Heronry Region.

HD-5

Incorporate Buffer Plans into the New Castle County Comprehensive Plan

Purpose:

The purpose of this strategy, in addition to supporting the passage of the New Castle County Unified Development Code, is to provide information and technology to New Castle County that will enable the development of sound regulations concerning both riparian buffer areas and woodland preservation.

Activities: (checked strategies have been implemented)

- ✓ 1. Support New Castle County's effort to adopt a Unified Development Code.
- ✓ 2. Provide New Castle County with GIS coverage and maps.

Progress:

The current New Castle County Unified Development Code (UDC) contains language regarding protection and enhancement of riparian buffer areas. Specifically, the UDC lists width requirements and specifies that all delineated riparian buffer areas are to be preserved within a parcel slated for development. It also specifies that existing native vegetation is to be preserved to the maximum extent possible and that efforts should be undertaken to eradicate any exotic species present (such as honeysuckle and multiflora rose). The UDC also specifies planting plans be prepared jointly with a landscape architect and other professionals and recommends appropriate plant species for re-vegetation efforts.

The following is an excerpt from the New Castle County Unified Development Code describing requirements of a Riparian Buffer Area:

An RBA consists of land that forms a transition zone between aquatic and terrestrial environments. RBAs include:

- One hundred (100) feet on either side of perennial and intermittent streams, lakes and tidal wetlands as well as land adjacent to identifiable stream channels that drain greater than ten (10) acres;
- All of the floodplain, plus an additional fifty (50) feet of adjacent land;
- All of a non-tidal wetland greater than twenty thousand (20,000) square feet in area, plus an additional fifty (50) feet of adjacent land;
- All of any size non-tidal wetland classified as a Piedmont Stream Valley Wetland, as defined in the 1997 New Castle County Comprehensive Plan Update and designated by the Delaware Natural Heritage Program, a Division of DNREC, plus an additional fifty (50) feet of adjacent land.

The Riparian Buffer Area shall consist of two (2) zones.

- A. Zone 1 is the land within twenty-five (25) feet of the water body or wetland. It shall also include any contiguous area of slopes in excess of fifteen (15) percent and erosion-prone slopes contiguous to and draining toward a floodplain or watercourse upstream of an existing public water supply intake.
- B. Zone 2 is the remainder of the Riparian Buffer.
- C. Identification and Calculation.
 - 1. Reserved.
 - 2. Initial Identification of the watercourse/waterbodies shall be made using the U. S. Geological Survey quadrangle maps or more accurate information, as available. Field verification to determine evidence and location of channelized flow is required for a specific determination.
 - 3. Measurements for the zone 1 boundary are to be made horizontally, perpendicular from the following reference points: Top of bank of perennial streams, and mean water level of lakes, ponds, and tidal wetlands. Measurements for the zone 2 boundary are to be made horizontally, perpendicular from the boundary of the environmentally sensitive lands.
 - 4. Measurements shall be made at appropriate intervals perpendicular to these reference points so as to accurately reflect the character of the adjacent land.
 - 5. The width of existing impervious area such as roadways, parking lots, structures, sidewalks, etc. shall not count towards the RBA measurements.
 - 6. Final determination of the boundaries of the RBA shall be made by the Department.
- D. Exceptions. An RBA shall not be designated along industrial ponds, sewage lagoons, man-made irrigation ditches, stormwater management basins and other artificial features with a similar water quality or storage function.

Future Direction:

Priority heron foraging sites in both Delaware and New Jersey will be identified and digitized in the coming months. Once this information is available, a strategy should be developed to encourage more stringent riparian requirements in areas adjacent or proximate to these sites. In addition, a program to encourage implementation of riparian buffers in already developed urban and suburban parcels should be developed. Attention could also be focused on non-developed areas.

Strategy Progress:

Habitat Improvement



Every strategy in the Habitat Improvement and Protection section has been initiated. Of note is an effort by the Delaware Coastal Management Program to map the historic cover of the invasive species *phragmites* for management and tracking purposes and a GIS project that maps and assesses protected areas within an expanded Heronry Region. In addition, habitat utilization studies have identified key wetlands in both Delaware and New Jersey that are important to the herons of Pea Patch. This information should help to improve management for these species and the habitats they depend upon.

The following pages provide detailed strategy progress reports for each strategy in the Habitat Improvement issue category of the SAMP. Each strategy report summarizes the intended purpose of the strategy, the original activities associated with the strategy and progress to date. Related non-SAMP activities and potential future direction were discussed when information was available.

HI-1

Secure Landowner Cooperation or Land Access/Control for Wetlands Restoration Projects

Purpose:

The purpose of this strategy is to provide guidance for public resource management agencies as to how to best proceed in choosing options to gain landowner cooperation or land access/control on a site-by-site basis.

Activities: (checked strategies have been implemented)

- ✓ 1. Identify the legal ability of public resource management agencies to restore or manage the coming and going of tides over private wetlands.
- ✓ 2. Develop a legally binding agreement form.
- ✓ 3. Assess the potential for achieving cooperative agreements through landowner organizations.

Progress:

The Delaware Division of Fish and Wildlife is the agency primarily responsible for projects involving manipulations of tidal flow for the purpose of wetland restoration on both private and public land in the state. The Implementation Team provided funding for the Division to conduct a legal review of the ability for public resource management agencies to restore or manage tidal flow over privately owned wetlands. The result of this review was that the state does have the legal ability under various authorities to manage tidal flow on privately held wetlands.

The Division of Fish and Wildlife has developed an agreement form for use in agreements between private landowners and the state for wetland restoration projects. This form has undergone legal reviews and is legally binding.

The potential for achieving cooperative agreements through landowner organizations has also been reviewed by the Division of Fish and Wildlife. It has been found that both agreements with individual landowners and establishment of landowner organizations (i.e. tax ditch associations) for the purpose of wetland restoration are acceptable and the appropriate method must be judged on a case by case basis.

HI-2

Reduce Phragmites and Other Invasive Species by 3,000 Acres throughout the PPIHR within 5-10 Years

Purpose:

The purpose of this strategy is to reduce the amount of phragmites and purple loosestrife present in the estuary and increase the amount of available quality wetland habitats over the next 10 years.

Activities: (checked strategies have been implemented)

- ✓ 1. Map the extent of phragmites (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*) within the PPI region
- ✓ 2. Assemble information on methods and timing for phragmites and purple loosestrife control.
- ✓ 3. Secure funding for control from state agencies, federal programs and other sources
- ✓ 4. Obtain permission to conduct control activities on affected marshes.
- ✓ 5. Implement control programs and any follow-up applications as needed
- ✓ 6. Adjust the program as indicated by the monitoring results.

Progress:

Mapping

The Delaware Coastal Management Program is currently engaged in preliminary analysis of historic *phragmites* cover in Delaware. The extent of *phragmites* over time will be analyzed with historic *phragmites* treatment data to better understand and quantify the expansion or reduction of *phragmites* and the help identify priority areas for treatment. Plans are being considered to expand this project to also analyze purple loosestrife.

Control Programs

The Delaware Division of Fish and Wildlife manage the state's phragmites control program and has conducted aerial herbicidal spraying and subsequent burning of phragmites in state wildlife areas since the 1980's. These efforts have reduced the monotypic stands of phragmites considerably and provided for increased biodiversity in those areas targeted for control activities.

In addition to control activities on public land, the Division of Fish and Wildlife offer a cost share program for landowners wishing to reduce phragmites cover on their land. This cost share program is funded on an annual basis by the Delaware Legislature. Interest in the program remains strong; on an annual basis about 30-40 landowners sign up for the program. In addition to individual landowners, land-holding organizations such as Delaware Wildlands, the Nature Conservancy and National Wildlife Refuges also participate in the cost-share program.

The following two tables show the total acres sprayed by the Delaware Division of Fish and Wildlife each year since 1996 in New Castle County and Kent County (from Bombay Hook National Wildlife Refuge to the Smyrna River). The acres treated with herbicide were calculated using the amount of herbicide solution applied, assuming 5 gallons will cover 5 acres. The actual ground acres treated will generally be less due to overlap and slow airspeeds.

**Acres treated for *Phragmites* in
New Castle County, DE (1996-2000)**

Year	Private Land	State-owned Land
1996	931	3450
1997	795	3275
1998	958	2247
1999	1502	1215
2000	1675	1131
Total	5861	11318

Table 4.

**Acres treated for *Phragmites* in
Kent County, DE (1996-2000)**

Year	Private Land	State-owned Land
1996	195	921
1997	330	440
1998	314	1430
1999	310	710
2000	260	732
Total	1409	4233

Table 5.

It has been found that initial treatments of an area with herbicide and subsequent burning for a 3-4 year period can result in 80-85% control of the *phragmites* in the treated area. This amount of control decreases the monoculture of *phragmites* and opens up areas for new vegetation and wildlife species. The remaining small stands of *phragmites* remain valuable for nesting wildlife that may have adapted to nesting in reedy substrate.

Future Direction:

Phragmites control programs in New Jersey are limited, at best. Most *phragmites* control has been the result of initiatives by the PSE&G Estuary Enhancement Program. Additional control programs on the New Jersey side of the river will be necessary for the goal of this strategy to be achieved.

The direction of *phragmites* control programs in both Delaware and New Jersey should be adjusted based upon results of the mapping initiative (described above). The historical maps will be able to show where control efforts have been successful, where they have not, and where new areas of concern may be located.

HI-3

Review Existing Restoration and Wildlife Plans for PPI Needs and Benefits

Purpose:

The purpose of this strategy is to evaluate existing wildlife and habitat management plans and where appropriate, make recommendations for incorporating management components into these plans that would address the conservation needs of long-legged wading birds.

Activities: (checked strategies have been implemented)

1. Establish working committees of technical experts in Delaware and New Jersey to review, evaluate and make recommendations as appropriate regarding long-legged wading bird needs/conservation.
- ✓ 2. Identify existing wildlife/habitat management plans within the PPI Heronry Region.
- ✓ 3. Schedule a plan review time frame and protocol.
- ✓ 4. Provide a written report and meet with landowner/managers to discuss recommendations and comments.
5. Develop a funding or in-kind service method to help implement plan recommendations.
6. Maintain a written record of active management implementation and results.
7. Develop a commitment to long term funding of the review process.
8. Coordinate with environmental education/outreach staff to effectively disseminate new information.
9. Monitor and review the revised management plan at a set interval (e.g. every five years).

Progress:

The Ratsep Group, Inc. was contracted by the Implementation Team to initiate this strategy by reviewing and reporting on available management plans in the Heronry Area. The original tasks to be completed were as follows:

1. Identification and review of existing wetland/habitat restoration and wildlife plans developed for all areas within the Heronry Region.
2. Develop a broad prioritization scheme for herons based on habitat that characterizes feeding and nesting habitats for each species.
3. Develop habitat coverage maps for each area identifying and categorizing the foraging and nesting habitat sites for each species of heron for each area based on available habitat information.
4. Develop a status report that reviews the existing conditions of the foraging and nesting habitats.

Due to information regarding the widespread nature of foraging habitats of the herons of Pea Patch Island, it was decided to extend the Pea Patch Island Heronry Region to include all of New Castle County, northern half of Kent County in Delaware, all of Salem County and the western half of Cumberland County in New Jersey for this project (see figures 11 and 14). The expansion of the original 15-kilometer heronry region, coupled with a severe lack of official management plans for managed natural areas resulted in changes to the original design of the project.

The expanded Heronry Region resulted in a total of 770 managed areas to review. The development of a project that presented existing conditions of the potential foraging and nesting habitats for herons for each of these areas became cumbersome according to the original task format identified. The alternative approach was to develop a web-based accessible database that provides reviewing and querying features for an endless combination of data querying and presentation formats and a GIS database.

Final Products:

1. Managed Areas CD-ROM – This CD-ROM allows users to view locations and obtain preliminary information about the 770 managed parcels in the expanded Pea Patch Island Heronry Region using ESRI's ArcView Software. Users can also view "potential" foraging and nesting habitats for 9 species of herons in each managed parcel (see Figure 16). These potential habitats are based solely on land classification and do not necessarily represent where herons would likely be found nesting or foraging. It is simply a rough guide.
2. Database Query System – The database query system is an extension of the GIS database that allows users who are not versed in ArcView to gather information about managed parcels, land use within those parcels and potential nesting and foraging habitat for herons. Efforts are still underway to get the database system in a useable web system.

Future Direction:

The completion of this initial project for this strategy is a significant step forward for tracking conservation areas. It is the first effort of its kind to map all conservation lands in the region. Many maps exist showing state owned land, or federally owned land, but this system shows the location of nearly all conservation lands in the Pea Patch Island Heronry Region, including state and federal lands, county lands, township and town lands and private conservation land and gives users the ability to query land use, wetland types and potential heron uses within them.

The next steps include:

1. Update source layers. A number of providers of source data noted that they were in the process of updating/revising the data layers provided.
2. Compile project metadata according to the Federal Geographic Data Committee guidelines after updating source layers and project layers.
3. Revise/modify the expanded PPIHR boundary based on new field data.

4. Revise/modify potential feeding and nesting criteria for the birds based on new research and field data.
5. Identify potential feeding and nesting areas critical for the birds based on new research and field data.
6. Development of additional GIS data layers of mapped boundaries.
7. Deploy the developed GIS project database access system on the Web as a restricted access for interested parties.
8. Review management plans as they become available.

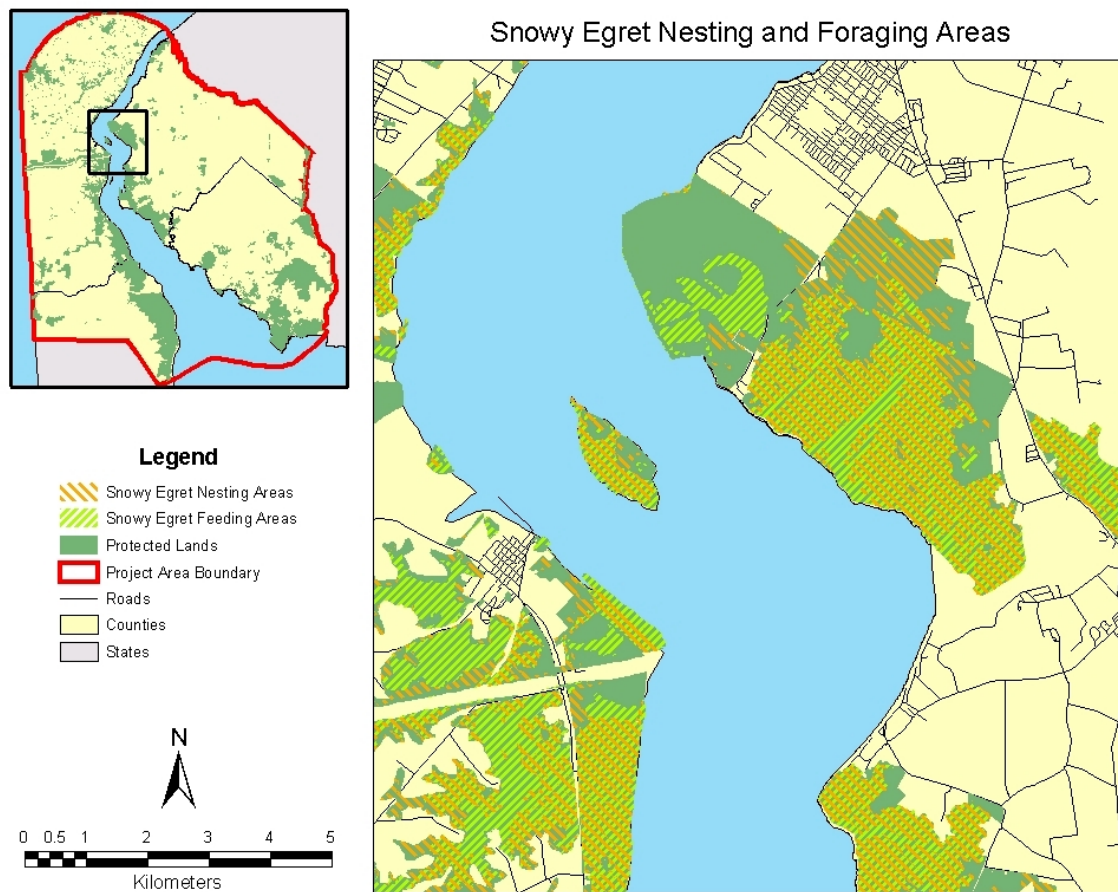


Figure 16. This figure is an example of the information available from the Managed Lands CD-ROM. Potential Snowy Egret nesting and foraging sites within protected areas are shown.

HI-4

Regenerate and Perpetuate Nesting Habitat on Pea Patch Island within 5 Years

Purpose:

The purpose of this strategy is to ensure the continued availability of nesting substrate for each species of heron on Pea Patch Island. Numerous trees and shrubs in the heronry have died recently, although many continue to flourish. These trees are important to the survivability of the heronry as lack of adequate nesting sites could lead to the eventual collapse of the heronry.

Activities: (checked strategies have been implemented)

- ✓ 1. Survey the existing forest community to establish a forest model of community composition, structure, and utility as nesting substrate for the heronry
- ✓ 2. Control erosion of existing island substrate.
- ✓ 3. Remove/control herbivores to reduce stress on the existing vegetation and the planted vegetation.
- 4. Remove/control competing exotic vegetation from the heronry forest (e.g., *Ailanthus altissima*).
- 5. Develop a phased revegetation plan that takes into account the season of planting, physical and logistical site constraints, ecological goals and costs.
- 6. Begin first phase of replanting un-vegetated areas based upon the established model, test planting, and timetable
- ✓ 7. Examine the continued use of *phragmites* as nesting substrate, as forest diversity and acreage increases over time.
- 8. Monitor the plantings and adjust the planting plan accordingly.

Progress:

Survey of forest community

The species of trees and shrubs used as nesting substrate for each species of heron on the island has been examined since 1992 as a component of the nesting and populations surveys conducted by Manomet Center for Conservation Sciences and the Delaware Division of Parks & Recreation. During the nesting surveys, tree and shrub species are recorded with numbers and types of nests. This effort has resulted in a better understanding of heron nesting substrate preferences. However, no specific model of community structure and composition has been completed to date and it remains a priority.

Erosion Control

The southeastern portion of Pea Patch Island (near Fort Delaware) has been the target area for a large-scale erosion control structure. This portion of the island has experienced the most severe erosion because it is the portion closest to the main shipping channel of the Delaware River and receives on-going wave action from passing ships.

The U.S. Army Corps of Engineers have sponsored the erosion control project which consists of stone rubble breakwater construction, mudflat filling and masonry wall reconstruction on the eastern side of the island, south of the heronry. The first phase, construction of the most southeastern breakwater, has been completed and work is on going to complete this section of the breakwater. No plans have been made to date to protect shoreline encompassing the heronry, but it remains a possibility in the future.

Herbivore Removal

The Division of Fish and Wildlife has sponsored controlled deer hunts on the island to curb population in past years. Currently, the deer population is in check and is not causing severe damage to vegetation in the heronry. If the deer population becomes problematic, the Division of Parks and Recreation and the Division of Fish and Wildlife will cooperate to sponsor controlled hunts to bring the population number to acceptable levels.

Phragmites as nesting substrate

The use of *phragmites* as nesting substrate is investigated during each population survey conducted on Pea Patch Island. *Phragmites* remains a viable nesting substrate and is consistently used by smaller herons each year. However, the portion of the overall population of species utilizing *phragmites* changes from year to year.

Future Direction:

The Delaware Division of Parks and Recreation is working cooperatively with Manomet Center for Conservation Sciences to develop a comprehensive Management Plan for Pea Patch Island and the Heronry. This plan will include components regarding vegetation management and erosion control. A forest model will be developed as part of the Management Plan and subsequent vegetative management practices will be based up on this model.

HI-5

Develop Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection

Purpose:

The purpose of this strategy is to develop a set of criteria for targeting and prioritizing land for acquisition or protection based on nesting and foraging habitat requirements for herons. The criteria as envisioned would be utilized in Delaware and New Jersey as additional ranking criteria for protection of critical habitats for the long-legged waders of Pea Patch Island.

Activities: (checked strategies have been implemented)

- ✓ 1. From the available wetland inventories in New Jersey and Delaware, identify all key wetlands important to PPI long-legged wading birds.
- ✓ 2. Identify all historic nesting habitats remaining within the PPIHR region.
- ✓ 3. Identify upland resources within the PPIHR region that provide important foraging habitat for cattle egrets.
- 4. Identify and characterize wetlands for possible restoration and improvement within the PPIHR.
- ✓ 5. Develop specific ranking criteria for foraging and nesting habitats identified, and evaluate the highest rated properties in the land acquisition and land protection programs in Delaware and New Jersey.

Progress:

Manomet Center for Conservation Sciences has conducted extensive wetland utilization studies since 1993. As a result, the primary foraging habitats for each species on the island has been identified. In addition, strategy HI-3 resulted in a database and GIS tool that demonstrates potential nesting and foraging sites within protected and public lands based upon land use and wetland type.

Manomet has found no more heronries in the immediate area, although there may be some evidence of an emerging nesting colony near Egg Island in New Jersey.

Manomet Center for Conservation Sciences has studied the foraging habits of cattle egrets since 1995 using radio telemetry. A GIS tool has been utilized by researchers that tracks locations of cattle egrets found.

A comprehensive list of species specific preferential foraging and nesting habitat information was compiled by Manomet in 2000. This list has potential uses for future acquisition and management efforts.

Strategy Progress: Human Disturbance



Human disturbance emerged as an issue category late in the original development of the Special Area Management Plan. While many of the strategies are the direct responsibility of the Division of Park and Recreation and will be addressed in the Management Plan for Pea Patch Island (currently under development), others address alternative education opportunities and effects of loud noises. Efforts are underway to develop alternative options to interpretive field trips into the heronry through educational strategies. Effects of loud noises have been studied and researchers and managers now have a better understanding of the Pea Patch Island herons' threshold tolerance to noise and presence of humans.

The following pages provide a detailed strategy progress report for the strategy in the Human Disturbance issue category of the SAMP. The strategy report summarizes the intended purpose of the strategy, the original activities associated with the strategy and progress to date. Related non-SAMP activities and potential future direction are also discussed.

HU-1

Manage Human Disturbance within the Pea Patch Island Heronry

Purpose:

The purpose of this strategy is to minimize the effects of human disturbance on the breeding colony at Pea Patch Island. A number of these strategies are an integral part of the Division of Parks and Recreation's overall management responsibilities on the island; other strategies are ideas that will require collaboration and funding from a number of stakeholders.

Activities: (checked strategies have been implemented)

- ✓ 1. Develop alternative interpretive options to field trips into the heronry.
- ✓ 2. Study effects of loud noises on the heronry and establish noise management policies.
- ✓ 3. Increase the visibility of signage surrounding the nature preserve, including signs in water near the heronry.
- ✓ 4. Maintain research protocol and monitor research activities at the heronry.
- ✓ 5. Maintain a vegetative buffer between Fort Delaware and the heronry.
- ✓ 6. Establish a photographic and media protocol for the heronry.
- ✓ 7. Recommend restrictions for over-flights of the heronry.
- ✓ 8. Confine management activities in the nature preserve to non-breeding season whenever possible.

Progress:

Heronry Field Trips

Annual field trips into the heronry were suspended by the Division of Parks and Recreation in 1997. A number of alternatives to these trips were listed in the Human Disturbance section of the Pea Patch Island Heronry Region SAMP (July 1998). Many of these alternatives (such as an interpretive center or "virtual heronry") are viable; however funding and/or staff resources have not been available.

Effects of Loud Noises

A small study was done in July 1998 to discern whether a newly acquired cannon for the Fort would affect the birds when fired. Video cameras were placed around the colony and six observers were stationed to monitor bird behavior during the firing. The 1.0 lb. and 1.5-lb. charges had no visible disturbance but the 2lb charge did cause vocalization within the colony. Decibel levels were monitored during the test firings. The cannon is currently fired using 1.5-lb. charges. The birds will quickly adjust to noises at this decibel level and it should cause no disturbance to the breeding colony.

Increase Visibility of Signage

Signs have been placed around the island warning any persons who might hazard upon them that the heronry is a protected area and heavy fines will result if they enter. Tentative plans exist to place signs near the heronry in the water to prevent boaters from approaching too closely or landing on sandy sections near the heronry. A practical method for achieving this is being investigated.

Monitor Activities within the Heronry

The Division of Parks and Recreation oversees any and all activities that occur within the boundaries of the heronry nature preserve. The Division must approve all research activities within the heronry on a yearly basis.

Management Activities

Management activities conducted by Parks and Recreation within the heronry are restricted to the non-breeding season. In addition, federal projects proximate to the heronry are also restricted to the non-breeding season.

Vegetative Buffer

The vegetative buffer (primarily *phragmites*, an invasive species) has been maintained between the Fort and the Heronry. Efforts to eradicate *phragmites* in this area and revegetate with native species were abandoned because research activities showed significant number of small herons utilizing the stands of *phragmites* as nesting substrate.

Media Protocol

Access to the heronry is limited and is directly overseen by the Division of Parks and Recreation. Any requests to access the heronry for photographic, print or video media purposes must be approved and any persons entering the heronry must be accompanied to ensure as little disturbance as possible. There have been no requests for media access to the heronry since 1999.

Overflights

Observations on Pea Patch Island have shown that direct overflights of fixed-wing aircraft and helicopters have little to no effect on heron behavior. However, helicopters that circle the island do have disruptive effects on the colony. Informal discussions with the U.S. Coast Guard halted circling of helicopters proximate to the island. A letter to the Federal Aerospace Administration (FAA) requesting air space restrictions over the island will be sent soon.

Related Activities:

The Division of Parks and Recreation, in cooperation with Manomet Center for Conservation Sciences, is developing a management plan for the heronry. It will provide a comprehensive management strategy for all activities listed above including vegetative management, predator control, deer and non-predator wildlife impacts, disturbance management of commercial activities (dredging, noise etc.), public access and fort activities. This plan will also address protocols for monitoring population and reproductive success and environmental education.

Future Direction:

The above mentioned management plan for Pea Patch Island will provide a comprehensive guide and set protocols for the human disturbance activities listed above. The completion of this document will fulfill the complete intent of this strategy.

Strategy Progress:

Oil Spills & Industrial Accidents



Due to the complex nature of many of the strategies outlined in this section and limited participation of experts in this field, many strategies in this section were not a high priority for implementation. However, a number of very important things have been accomplished in this category. The Delaware Bay and River Cooperative has established a system for booming the island in its entirety. The new technique promises to provide enormous protection for the island in the event of an oil spill. In addition, Tri-State Bird Rescue and Research has conducted workshops regarding hazing, retrieval and transfer plans for herons. These workshops demonstrated the extreme difficulties of hazing and retrieval of long-legged wading birds and documented that the best solution is to avoid or contain spills before they become problematic for wildlife.

Two strategies that continually ranked high with the Implementation Team but could not be initiated were OS-1 and OS-2. OS-1 would produce oil spill damage estimates for sensitive areas, and would be a mechanism for encouraging oil companies and the shipping industry to take proactive measures to minimize damage in the event of a spill. OS-2 would standardize oil transfer regulations in the Delaware River and Bay. This strategy was not initiated because it would require involvement of three states and passage of proposed legislation would not be assured.

The following pages provide detailed strategy progress reports for the strategies in the Oil Spill and Industrial Accidents issue category of the SAMP. The strategy report summarizes the intended purpose of the strategy, the original activities associated with the strategy and progress to date. Related non-SAMP activities and potential future direction are also discussed when information was available.

OS-1

Produce Oil Spill Damage Assessment Estimates for Sensitive Areas

Purpose:

The purpose of this strategy is to develop natural resource value estimates for sensitive areas in the Pea Patch Island Heronry Region that could be used as part of an oil spill damage assessment. These estimates could be used to educate industry, decision-makers and the public about the value these areas represent. It is anticipated that increased awareness of the dollar value of these sensitive areas and the resources they contain will motivate responsible parties to focus spill prevention and response assets and capabilities on this critical region.

Activities:

1. Select sensitive area(s) where estimates will be developed.
2. Identify valuation technique(s).
3. Identify/ quantify resources at risk.
4. Produce damage estimates based on spill scenarios.
5. Provide estimates to potentially liable parties.

Progress:

The SAMP Implementation Team has not initiated this strategy to date.

OS-2

Standardize Oil Transfer Regulation in the Delaware River and Bay

Purpose:

The purpose of this strategy is to develop legislation for adoption by the appropriate legislative authorities in the three states adjacent to the Delaware Bay/River to require the booming of vessels involved in the bulk transfer of oil.

Activities:

1. Evaluate existing legislation to determine where revisions are required.
2. Draft proposed legislation that encompasses all types of transfers.
3. Submit proposals to each state assembly and market/justify. Gain support/sponsor.
4. Provide draft regulations to each appropriate state regulating body.
5. Ensure mechanism is in place to get law passed-regulations adopted.

Progress:

This strategy has not been initiated by the Implementation Team to date.

OS-3

Pre-stage Appropriate Spill Response Resources Near Sensitive Areas

Purpose:

The purpose of this strategy is to ensure that any needed spill response resources identified as part of a spill drill are available when and where they would be necessary during a real spill.

Activities:

1. Evaluate response plans after drills to determine need for additional pre-staging.
2. Develop material and storage cost estimates for additional pre-staging, where necessary.
3. Submit proposals to appropriate institution(s).
4. Follow up to see that response resources are in place.

Progress:

The SAMP Implementation Team has not initiated this strategy to date.

OS-4

Ensure that the Salem River Response Plan is Effective

Purpose:

The purpose of this strategy is to develop a response plan for the protection of the sensitive areas in and upstream of the Salem River in New Jersey. There are questions to whether the existing response plan is adequate due to difficulty in booming the fast moving tidal currents at the mouth of the river.

Activities: (checked strategies have been implemented)

- ✓ 1. Hold spill drill for Salem River.
- 2. Evaluate drill and identify areas of concern.
- 3. Identify similar situations in the response community.
- 4. Investigate means of addressing concerns.
- 5. Modify response plan as necessary.

Progress:

Spill drills have been held for the Salem River and have demonstrated that a spill affecting this area may be difficult to deal with, as booming is difficult due to strong currents.

Future Direction:

Because of the special problems related to spills affecting the Salem River, the best way to protect resources may be to develop alternate preparedness plans for this specific region, including wildlife hazing plans.

OS-5

Establish Permanent Anchor Points for Booming

Purpose:

The intended purpose of this strategy is to evaluate the need for permanent booming points in the Heronry Region, identify priority sites, and install any needed points.

Activities: (checked strategies have been implemented)

1. Assess need for permanent points in the heronry region and establish priority sites.
2. Field test locations for effectiveness.
3. Report results of tests and forward for approval.
- ✓ 4. Install anchor points.

Progress:

The formal assessment of sites for anchor points (activity 1) has not been undertaken, but an opportunity arose for the Implementation Team to improve the mechanism for oil spill protection at Pea Patch Island by aiding in the establishment of permanent buoy anchor sites for booming.

The SAMP Implementation Team provided matching funding to the Delaware Bay and River Cooperative to establish a series of buoys around Pea Patch Island to be used as permanent booming anchor sites. In the fall of 1999, DBRC installed twenty-two buoys around the northern end of the island as a test. During that winter, icing damaged all of the buoys that were installed. DBRC will replace the damaged buoys with ice spar buoys in the fall of 2000. If these buoys withstand icing through the winter, ice spar buoys will be placed around the southern side of the island as well.

This system of buoy anchor points provides the herons of Pea Patch Island much improved protection against spills in the Delaware River. The previous method of protecting the island involved anchoring individual boom sections to the island itself, with each section designed to deflect oil to the next section, and ultimately away from the island. This system was problematic: strong winds could push oil into the island instead of away from it, there could be difficulties attaching the boom to the shoreline, and the boom had to be reconfigured for each ebb and flood tide. The new buoy system creates a ring around the island for quick boom set-up and provides far more oil spill protection for the herons.

Future Direction:

A digital product that shows the locations of protected and non-protected heron foraging and nesting areas should be developed as a reference for emergency response professionals and planners.

OS-6

Hold Spill Drills for all Sensitive Areas

Purpose:

The purpose of this strategy is to test the effectiveness of oil spill response dedicated to the protection of the sensitive areas surrounding Pea Patch Island.

Activities:

- ✓ 1. Identify all sensitive areas within 15 km of Pea Patch Island.
- 2. Obtain existing schedule for drills and prioritize.
- 3. Identify response resources necessary to implement drills.
- 4. Request that responsible institutions conduct drills.
- 5. Evaluate/ modify response plans.

Progress:

Sensitive areas within the Pea Patch Island Heronry Region were identified as part of the SAMP issue characterization work. A map of these locations is shown in the Pea Patch Island Heronry Region SAMP (July 1998).

The SAMP Implementation Team has not initiated other activities related to this strategy.

OS-7

Incorporate Hazing, Retrieval, and Transfer Plan into Wildlife Response Protocol

Purpose:

The purpose of this strategy is to develop three plans that will be included in the existing Wildlife Response Protocol for the Oil Spill Contingency Plan for the Port of Philadelphia Area. The first is a plan to haze wading birds from the areas that maybe threatened during a spill event. The second plan is designed to provide for the efficient retrieval of live and dead wildlife by qualified individuals during a spill event. The third plan complements the second by designing means of transferring live animals and remains of dead ones to the appropriate rehabilitation or storage facilities.

Activities: (checked strategies have been implemented)

- ✓ 1. Determine seasonal pattern of Pea Patch Island use by wading birds.
- ✓ 2. Evaluate possible hazing techniques.
- ✓ 3. Develop hazing plan and implement.
- ✓ 4. Develop retrieval plan and implement.
- 5. Establish and train wildlife retrieval teams for Pea Patch Island.
- ✓ 6. Develop transfer plan and implement.
- 7. Drill all three plans.

Progress:

Tri-State Bird Rescue & Research hosted two workshops in the fall of 2000. The first workshop addressed the effectiveness of hazing long-legged wading birds and possible techniques for doing so. The second workshop addressed retrieval and transfer of oiled or hurt long-legged waders. The discussions and resulting recommendations of the group were summarized and distributed to participants. The final document will be submitted to the Philadelphia Port Area Committee for inclusion in the Area Contingency Plan.

Future Direction:

The next steps in this strategy will be to achieve the formal agreements and training needed to carry out a hazing operation and drill.

It will be crucial to establish and train wildlife retrieval teams familiar with long-legged waders after retrieval and transfer plans are in final forms.

Strategy Progress:

Outreach and Education



Outreach and education efforts to increase awareness of the Heronry have been helpful in the Region, however less effort has been concentrated in New Jersey than in Delaware largely because the SAMP is viewed as a Delaware issue. Although general awareness of the heronry has increased due to presentations, newspaper articles, television specials and newsletters, the SAMP itself is still not well recognized in either state. A plan for future outreach efforts has been developed and the Implementation Team will continue to pursue outreach and education opportunities as they arise.

The following pages provide a detailed strategy progress reports for the strategy in the Human Disturbance issue category of the SAMP. The strategy report summarizes the intended purpose of the strategy, the original activities associated with the strategy and progress to date. Related non-SAMP activities and potential future direction are also discussed.

OE-1

Outreach and Education that will Create a Greater Awareness of the Heronry

Purpose:

The purpose of this strategy is to develop a multi-phased communication and education outreach effort that creates a greater awareness and understanding of the heronry and its importance for the general public and targeted audiences.

Activities: (checked strategies have been implemented)

1. Assessment.
- ✓ 2. Identification.
- ✓ 3. Planning and enrollment.
- ✓ 4. Development of specific outreach products.
- ✓ 5. Monitoring and measurement.
- ✓ 6. Continued enrollment/networking activities.

Progress:

A number of outreach and educational products have been developed in conjunction with the SAMP. In addition, Implementation Team members have attended events and participated in other functions to increase the general awareness of the heronry and its importance. This strategy has been successful in increasing general knowledge of the heronry.

Assessment

A formal assessment of educational activities involving the heronry has not been undertaken. However, educational components for the heronry existed within the Division of Parks and Recreation before the initiation of the SAMP effort.

Identification

Opportunities arose early in the SAMP process to develop some broad-reaching educational products about the heronry before an assessment was initiated. It was decided to pursue these immediate opportunities rather than to wait for a formal assessment and identification to be complete.

The outreach and education task group began to identify target audiences and potential outreach products formally in 1999. This effort resulted in the Action Plan for Outreach and Educational Activities for the Pea Patch Island Special Area Management Plan. The target audiences as identified by the plan are 1) registered voters in the state of Delaware; 2) members of the Delaware General Assembly; and 3) science teachers in Delaware, their students and parents.

Because long-term protection of the heronry will most likely require new legislation or regulations, the support of voters and the legislators in Delaware will be essential. In addition, teachers are a critical link for education children to help ensure protection into the future. A list of outreach products for these groups can be found in the section Future Outreach Products, below.

Planning and Enrollment

An Action Plan for Outreach and Educational Activities for the Pea Patch Island Special Area Management Plan was developed by the Outreach and Education Task Group in 1999. This brief document outlines goals, objectives, target audiences, messages, formats, distribution mechanisms and evaluation indicators. It also outlines a timetable and costs of each educational product.

Specific Outreach Products

Video Media

Mike Oates of Anew, Inc. has worked extensively to obtain and produce video footage of the heronry and involved persons for a number of video presentations that are useful for a range of target audiences. These videos have been used at public events (such as Coast Day), public workshops and for presentations to specific audiences. The products currently available for use include:

- The Pea Patch Island SAMP – approximately 15 minutes in length. This video includes video footage of the heronry, interviews with SAMP participants and information about each issue category.
- Pea Patch Island Heronry – approximately 8 minutes in length. This video features background historical and ecological information about the herons on Pea Patch Island, with little to no mention of the SAMP effort.

In January of 1999, Philadelphia public television station WHYY produced and aired a special news series for a program called 12 Tonight that highlighted SAMP issues. This program was a three part series; segment 1 covered background information about the heronry and gave an overview of herons as environmental indicators, segment 2 gave an overview of the issue categories and segment 3 gave an overview of the SAMP, including its impact on public and private spaces and suggestions for public participation. Each taped section was followed by live roundtable discussions.

Printed Media

A number of articles about the heronry and the SAMP have appeared in magazines, newspapers and newsletters. The Smithsonian magazine did an article about urban heronries (including Pea Patch Island) in April 1999. Articles about the heronry and the SAMP have also appeared in Conservation Sciences (the magazine of the Manomet Center for Conservation Sciences) and Outdoor Delaware (the magazine of the Delaware Department of Natural Resources and

Environmental Control). Articles have also appeared in Non-Point Source News and newsletters of the Delaware Estuary Program. These articles have primarily served to increase awareness of the existence and importance of the Pea Patch Island Heronry.

In addition to the above, in January 1999, just prior to the initial airing of the WHY? 3-part series, 71,000 copies of a newsletter entitled “News from the Pea Patch Island Heronry Region Special Area Management Plan” was distributed as a special insert in the Wilmington News Journal. This newsletter discussed the heronry and the Special Area Management Plan and advertised the WHY? special.

Other

In addition to the video and print media items above, there are several other products available for outreach activities. A set of slides including close-up shots of each species is available and additional copies can be made upon request. A large display was created in 1997 for outreach at public events and is still in fairly good condition.

Future outreach products

The education and outreach task group has developed a number of products and outreach opportunities they wish to implement. This list includes development of a new logo, distribution of news releases, development of an informational web site, development of new display, informational placements for local restaurants, kickoff events and enhancement of current videos.

Monitoring and Measurement

Measurement of the effectiveness of outreach and education efforts and reviews of the overall outreach plan are undertaken regularly on an informal basis, usually corresponding to release or use of a specific outreach tool.

Continued Enrollment/Networking Activities

SAMP Implementation Team members continually explore and suggest new opportunities to develop and present SAMP outreach and educational tools.

Future Direction:

The Action Plan describes outreach products and events that will be implemented in the near future. In addition to these products however, it is crucial that the SAMP Implementation Team members continue to coordinate with other agencies and organizations to disseminate information and seek opportunities for additional outreach strategies and activities.

Strategy Progress:

Pesticides



Strategies contained within the Pesticide section primarily deal with education and quantification of pesticide use. Quantifying pesticide use within the Heronry Region remains a high priority for the Implementation Team, but efforts to implement the strategy in Delaware were unsuccessful. Delaware does not collect data regarding pesticide use; however, New Jersey does have information available about pesticide usage within its state boundaries. Pesticide strategies dealing with education efforts were not formally initiated and pesticide educational efforts in Delaware do not have a Pea Patch Island component. The Pesticide strategies should be revisited in light of changing organophosphate regulations and recent research findings.

The following pages provide detailed strategy progress reports for each strategy in the Pesticides issue category of the SAMP. Each strategy report summarizes the intended purpose of the strategy, the original activities associated with the strategy and progress to date. Related non-SAMP activities and potential future direction were discussed when information was available.

PE-1

Maintain/Expand Pest Management Educational Efforts

Purpose:

The goal of this strategy is to incorporate information resulting from SAMP research activities into existing programs that disseminate information about pest management practices throughout the community.

Activities:

1. Inventory existing programs.
2. Increase pest management education for homeowners.
3. Develop new practices based on research results.
4. Focus educational efforts on the Pea Patch Island Heronry Region.

Progress:

Little has been done to formally incorporate the Pea Patch Island Heronry as a formal component of pesticide educational activities in Delaware.

Related Activities:

The New Castle County Cooperative Extension Agency conducts outreach activities for homeowners that involve aspects of integrated pest management. Each year, an average of 4,000 people are contacted by telephone and mail. About 650 persons per year attend workshops and lectures sponsored by Cooperative Extension and about 1,000 persons attend community displays and demonstration gardens. Feature articles for local papers on average of 24 per year and radio shows on local station WDEL are targeted to home lawn and garden audiences.

Cooperative Extension and the Delaware Department of Agriculture also conduct educational programs for pesticide safety. Anyone applying pesticides for hire or to the lands of another must be certified and licensed by the Delaware Department of Agriculture as commercial applicators. The training emphasizes safety for the applicator, the environment and the public. Training covers laws, calibration of instruments, drift control, personal protective equipment, ground water and endangered species protections, environmental protection, understanding labels, pest identification and pest control. More information can be obtained on the web at www.udel.edu/pesticide/howto.htm

Future Direction:

A Pea Patch Island Heronry component could be added to outreach activities for homeowners in the Heronry Region. As an example, presentations to homeowners about safe pesticide use could use herons as an example of possible pesticide exposure pathways. Cooperation between agencies will be needed.

PE-2

Determine Pesticide Use by Land Use

Purpose:

The purpose of this strategy is to identify and attempt to quantify pesticide usage from a variety of land uses within the study area. Manomet Center for Conservation Sciences will utilize this information for research into the health of the herons on Pea Patch Island.

Activities:

1. Develop a screening and sampling procedure for non-agricultural area pesticide use.
2. Identify the agricultural contribution within 15-kilometer study area.
3. Collect non-agricultural data.
4. Edit and summarize data.
5. Write final report.
6. Evaluate the results and decide whether additional years of data are needed.

Progress:

A screening and sampling procedure was drafted by the Delaware Agriculture Statistics Service (DASS) for measuring agricultural pesticide use in Delaware. This method relied heavily on questionnaires that would be distributed and filled out by farmers. However, because a number of other projects were utilizing this method at the same time the pesticide survey would have been sent out, DASS felt that the respondent burden would be too high and the pesticide survey would not provide the needed data. This particular project was discontinued.

No protocol has been developed for collection and analysis of non-agricultural pesticide use. Data collection for such a study might prove to be difficult and/or problematic in the state of Delaware.

This strategy remains a high priority with Implementation Team members because data related to types and quantities of pesticides used in the Heronry Region could provide links to heron health and reproductive success in the region.

Related Activities:

The New Jersey Pesticide Control Program conducts pesticide use surveys on a regular basis. Agricultural pesticide use surveys began in 1985 and are done every three years to target agricultural, nursery and greenhouse use of general and restricted pesticides. Lawn care surveys were initiated in 1990, 1995 and 1998 and were targeted at licensed applicators. Surveys have also been conducted for golf course pesticide usage every three years beginning in 1990. Summary reports of each survey are available from the New Jersey Pesticide Control Program or on the web at <http://www.state.nj.us/dep/enforcement/pcp/pem-survey.htm>.

All NJ statewide pesticide use surveys are performed under the authority of the New Jersey Pesticide Control Code that requires applicators to maintain pesticide records for two years and to submit use records to the state when requested. This regulative authority provides an accuracy and level of response that is difficult to duplicate in a voluntary, nationwide survey. Survey response is very high, usually better than 90%.

Future Direction:

The existing information regarding pesticide usage in New Jersey should be analyzed for potential impacts on herons. Efforts should continue in the state of Delaware to begin a comprehensive survey of pesticide usage.

PE-3

Inventory Control Activities and Programs for Invasive Plants, Noxious Weeds and Aquatic Plants

Purpose:

The goal of this strategy is to inventory and assemble a list of control activities and programs for invasive plants, noxious weeds and aquatic weeds within the 15-km radius of the heronry and to identify effects of these activities on birds, prey items, habitat and nesting site availability.

Activities:

1. Develop a list of programs/activities.
2. Identify known impacts of control programs on the heronry.
3. Develop a GIS coverage.
4. Write final report.

Progress:

This strategy has not been formally initiated by the Implementation Team.

Conclusion



Significant progress has been made implementing the Pea Patch Island Heronry Region SAMP, but its continued success is not assured. To date, implementation has been very successful as a direct result of the dedicated implementation funding under Section 309 of the CZMA. Although these funds have successfully been used to leverage other funds, no dedicated funding source for long-term, continued implementation of SAMP activities has been identified.

The implementation of the SAMP has been somewhat hindered due to its broad and seemingly all encompassing scope. This scope has made it extremely challenging to maintain focus and garnish support for the Plan. This broad scope was largely a result of extensive efforts to build consensus during SAMP development. In addition, consensus was normally accomplished by serious compromises that, in some ways, watered down the recommended actions set forth in SAMP strategies.

The Delaware Coastal Management Program will continue to support the administration of the SAMP as part of its base program, providing staffing and other resources to help ensure its long-term success. The Implementation Team will begin reassessing strategies and goals of the 1998 SAMP in 2001. As a result, new initiatives will be put forth for the protection and improvement of the Pea Patch Island Heronry and Heronry Region.

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Definitions of Acronyms



CAFRA	New Jersey's Coastal Area Facility Review Act
CES	Cooperative Extension Service
CZMA	Delaware's Coastal Zone Management Act
DBRC	Delaware Bay and River Cooperative
DCMP	Delaware Coastal Management Program
DDA	Delaware Department of Agriculture
DELEP	Delaware Estuary Program
DNREC	Delaware Department of Natural Resource and Environmental Control
DPR	Delaware Department of Parks and Recreation
EPA	United States Environmental Protection Agency
ESRI	Environmental Systems Research Institute
GIS	Geographic Information System
LUPA	Delaware's Land Use Planning Act
NCCD	New Castle County Conservation District
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priority List
OCRM	NOAA's Office of Ocean and Coastal Resource Management
OSPC	Delaware Office of State Planning Coordination
PCB	Polychlorinated Biphenyls
PPI	Pea Patch Island
PPIHR	Pea Patch Island Heronry Region
PSE&G	Public Service Electric and Gas Company
RCRA	Resource Conservation Recovery Act
SAMP	Special Area Management Plan
SRA	Delaware State Resource Areas
USCA	United States Coastal Act
UDC	Unified Development Code
USACE	United States Army Corp of Engineers
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFWS	United State Fish and Wildlife Service
WILMAPCO	Wilmington Area Planning Council

<i>SAMP Implementation Status</i> <i>June, 2001</i> * <i>Shaded strategies were funded by the SAMP</i>		Activity Progress			Proposed Lead Institution
		Not Undertaken	Current or On-going	Completed	
HABITAT CHANGE AND DEVELOPMENT					
HD-1	Ensure Adequate Funding to Protect Habitat through Fee Simple Land Acquisition				DPR
	-Identify and evaluate all options for funding of fee simple acquisition	✓			
	-Prioritize options	✓			
	-Build public and political support for priority options	✓			
HD-2	Develop a Land Preservation Tool Box				OSPC
	-Design and develop how-to guide	✓			
	-Enhance and enlarge State Planning web page			✓	
	-Distribute guides	✓			
HD-3	Establish a Means to Recognize Property Owners and Developers that Help Preserve Natural Habitats				OSPC
	-Review efforts to establish awards program			✓	
	-Identify eligible property owners and developers	✓			
	-Advertise awards program	✓			
HD-4	Develop Criteria for Determining Riparian Buffer Area Overlays				DNREC
	-Identify priority buffer zone objectives by use			✓	
	-Assess site conditions throughout region			✓	
	-Review literature			✓	
	-Publish summary report			✓	
	-Conduct seminar of findings	✓			
	-Determine program structure options for implementation of criteria	✓			
HD-5	Incorporate Buffer Plans into the New Castle County Comprehensive Plan				DNREC
	-Support NCCo's efforts to adopt a UDC			✓	
	-Provide NNCo with GIS coverages and maps			✓	
PESTICIDES					
PE-1	Maintain/Expand Pest Management Educational Efforts				CES
	-Inventory existing programs	✓			
	-Increase pest management education for homeowners	✓			
	-Develop new practices based on research results	✓			
	-Focus educational efforts on PPIHR	✓			
PE-2	Determine Pesticide Use by Land Use				DDA
	-Develop a screening and sampling procedure			✓	
	-Identify the agricultural contribution	✓			
	-Collect non-agricultural data	✓			
	-Edit and summarize data	✓			
	-Write final report	✓			
	-Evaluate results	✓			
PE-3	Inventory Control Activities and Programs for Invasive Plants, Noxious Weeds and Aquatic Plants				NCCD

<i>SAMP Implementation Status</i> <i>June, 2001</i> <i>* Shaded strategies were funded by the SAMP</i>		Activity Progress			Proposed Lead Institution
		Not Undertaken	Current or On-going	Completed	
	-Develop list of programs/activities	✓			
	-Identify known impacts on heronry	✓			
	-Develop GIS coverage	✓			
	-Write final report	✓			
CONTAMINANTS					
C-1	Evaluate and Assess Impacts of Confined Disposal Sites within the 15 km Foraging Area				Manomet
	-Determine usage and benefits of CDFs for avian species		✓		
	-Define the operations and maintenance of CDFs		✓		
	-Assess impacts and identify options		✓		
	-Implementation and monitoring	✓			
C-2	Establish and Implement Sediment and Water Quality Criteria for Avian Species				Manomet
	-Identify levels of contamination for prey items at various trophic levels			✓	
	-Identify data gaps and obtain data			✓	
	-Identify sources of available information			✓	
	-Develop a bioaccumulation model	✓			
	-Establish appropriate criteria	✓			
C-3	Establish a Consistent Framework and Information Management System for Dredging Decision Making				DCMP
	-Conduct workshop on existing dredging policy framework			✓	
	-Revise and implement the dredging policy framework			✓	
	-Conduct a second workshop	✓			
	-Develop a supporting information management system		✓	2001	
C-4	Target Pollution Prevention at Industries that Release Contaminants of Concern				DNREC
	-Identify contaminants of concern			✓	
	-Identify industries and businesses that release contaminants of concern			✓	
	-Offer technical advice	✓			
	-Implement technical advice	✓			
C-5	Assess Effects of Industrial Contaminants and Pesticides on Wading Birds				Manomet
	-Quantify contaminant exposure		✓		
	-Monitor birds for exposure effects		✓		
	-Establish links between exposure and effects		✓		
	-Establish causality through controlled lab studies		✓		
	-Develop , implement and monitor management actions		✓		
C-6	Prioritize Sites for Cleanup According to Wading Bird Usage				USFWS
	-Obtain NPL, RCRA and state haz waste sites within PPIHR	✓			
	-Identify sites with habitat risks and contaminants of concern	✓			
	-Conduct literature search	✓			

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		Not Undertaken	Current or On-going	Completed	
	-Determine projected clean up schedule	✓			
	-Finalize list	✓			
	-Determine usage of sites by wading birds	✓			
	-Rank/prioritize sites for clean-up	✓			
OIL SPILLS/INDUSTRIAL ACCIDENTS					
OS-1	Produce Oil Spill Damage Estimates for Sensitive Areas				DNREC
	-Select areas where estimates will be developed	✓			
	-Identify valuation techniques	✓			
	-Identify/quantify resources at risk	✓			
	-Produce damage estimates based on spill scenarios	✓			
	-Provide estimates to potentially liable parties	✓			
OS-2	Standardize Oil Transfer Regulations in Delaware River/Bay				DELEP
	-Evaluate existing legislation to determine where revisions are required	✓			
	-Draft proposed legislation that encompasses all types of transfers	✓			
	-Submit proposals to each state assembly and market/justify	✓			
	-Provide draft regulations to each appropriate state regulating body	✓			
	-Ensure mechanism is in place to get law passes/regs adopted	✓			
OS-3	Prestage Appropriate Spill Response Resources Near Sensitive Areas				USCG
	-Evaluate response plans after drills to determine need	✓			
	-Develop materials and storage cost estimates for additional prestaging	✓			
	-Submit proposals to appropriate institutions	✓			
	-Follow up to see that response resources are in place	✓			
OS-4	Ensure that Salem River Response Plan is Effective				USCG
	-Hold spill drill for Salem River			✓	
	-Evaluate drill and identify areas of concern			✓	
	-Identify similar situations in the response community	✓			
	-Investigate means of addressing concerns	✓			
	-Modify response plan as necessary	✓			
OS-5	Establish Permanent Anchor Points for Booming				DBRC
	-Assess need for permanent points			✓	
	-Field test locations for effectiveness			✓	
	-Report results of tests and forward for approval		✓		
	-Install anchor points			✓	
OS-6	Hold Spill Drills for All Sensitive Areas				DBRC
	-Identify all sensitive areas		✓		
	-Obtain existing schedule for drills and prioritize	✓			
	-Identify response resources necessary to implement drills	✓			
	-Request that responsible institutions conduct drills	✓			
	-Evaluate/modify response plans	✓			

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		Not Undertaken	Current or On-going	Completed	
OS-7	Incorporate Hazing, Retrieval, and Transfer Plans in Wildlife Response Protocol				Tri-State
	-Determine seasonal pattern of PPI use by wading birds			✓	
	-Evaluate possible hazing techniques			✓	
	-Develop hazing plan and implement		✓		
	-Develop retrieval pan and implement		✓		
	-Establish and train wildlife retrieval teams for PPI				
	-Develop transfer plan and implement		✓		
	-Drill all three plans	✓			
HABITAT IMPROVEMENT AND PROTECTION					
HI-1	Secure Landowner Cooperation or Land Access/Control for Wetlands Restoration Projects				DNREC
	-Identify the legal ability			✓	
	-Develop legally binding agreement form			✓	
	-Assess the potential for achieving cooperation through landowners orgs.			✓	
HI-2	Reduce Phragmites and Other Invasive Species				DNREC
	-Map extent of Phragmites and purple loosestrife in PPIHR		✓		
	-Assemble info on methods and timing		✓		
	-Secure funding for control		✓		
	-Obtain permission to conduct control activities		✓		
	-Implement control programs and any follow-up		✓		
	-Adjust the program as indicated by monitoring results		✓		
HI-3	Review Existing Restoration and Wildlife Plans for PPI Needs and Benefits				DNREC
	-Establish working committees of technical experts			✓	
	-Identify existing wildlife/habitat plans within PPIHR			✓	
	-Schedule a plan, review time frame and protocol			✓	
	-Provide a written report and meet with landowners/managers	✓			
	-Develop a funding or in-kind service method	✓			
	-Monitor and review revised management plan at a set interval	✓			
	-Maintain a written record of active management implementation	✓			
	-Develop a commitment to long term funding of the review process	✓			
	-Coordinate with environmental EO staff	✓			
HI-4	Regenerate and Perpetuate Nesting Habitat on PPI				DNREC
	-Survey existing forest community		✓		
	-Control erosion of existing island substrate		✓		
	-Remove/control herbivores		✓		
	-Remove/control exotic vegetation		✓		
	-Develop a revegetation plan	✓			
	-Begin first phase of replanting un-vegetated areas	✓			
	-Examine the continued use of Phragmites as nesting substrate		✓		

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		Not Undertaken	Current or On-going	Completed	
	-Monitor the plantings and adjust plan accordingly	✓			
HI-5	Develop Site Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection				DNREC
	-Identify key wetlands important to PPI herons			✓	
	-Identify all historic nesting habitats remaining in PPIHR			✓	
	-Identify upland resources for cattle egrets			✓	
	-Identify and characterize wetlands for restoration and improvement	✓			
	-Develop specific ranking criteria		✓		
HUMAN DISTURBANCE					
HU-1	Managing Human Disturbance within PPI Heronry				DPR
	-Develop alternative interpretive options to field trips into the heronry		✓		
	-Study effects of loud noises and establish noise management policies		✓		
	-Increase the visibility of signage around the heronry		✓		
	-Maintain research protocol and monitor research activities in the heronry		✓		
	-Confine management activities to non-breeding seasons		✓		
	-Maintain a vegetative buffer between Fort Delaware and the heronry		✓		
	-Establish a photographic and media protocol for the heronry	✓			
	-Recommend restrictions for overflights	✓			
OUTREACH AND EDUCATION					
OE-1	Communication/Outreach that Creates a Greater Awareness of the Heronry				DNREC
	-Assessment			✓	
	-Identification			✓	
	-Planning and enrollment		✓		
	-Development of specific outreach products		✓		
	-Monitoring and measurement	✓			
	-Continue enrollment/networking activities	✓			

Preliminary Strategies (1997)



*The following is a list of every preliminary strategy developed as a result of the April 2, 1997 SAMP Strategy Workshop. Only a portion of the strategies listed in this section were fully developed and fewer still were incorporated into the 1998 SAMP. Strategies marked * were written up and included in the Strategy Workshop Summary Document as draft strategies. Strategies marked ** were further refined and incorporated into the 1998 SAMP.*

Contaminants Strategies

C-1 Reduce contaminants impacts associated with dredging and spoil disposal

- C-1.1** Improve operation & maintenance of confined disposal sites
- C-1.2* Restrict open water disposal of contaminated materials
- C-1.3** Establish sediment & water quality criteria for fish & wildlife
- C-1.4** Establish a consistent interstate framework for reviewing dredging projects
- C-1.5* Establish a protocol for screening sediment at resolution that permits segregation and disposal of "hot spots"
- C-1.6* Establish an information management system for dredging decision making

C-2 Reduce contaminants impacts from industrial and municipal effluents

- C-2.1* Add fish and wildlife criteria to the Total Daily Maximum Loading process
- C-2.2** Target pollution prevention at industries that release contaminants of concern
- C-2.3* Ensure adequate enforcement of NPDES

C-3 Determine other sources of contaminants of concern

- C-3.1* Reduce Nonpoint Source Stormwater Impacts
- C-3.2* Establish monitoring program to evaluate atmospheric deposition contributions

C-4 Determine connection between contaminants and wading birds

- C-4.1** Quantify effects (or lack of) of contaminants on wading birds

C-5 Eliminate contaminants impacts from hazardous waste sites

- C-5.1** Prioritize sites for clean-up according to wading bird use

Habitat Change and Development Strategies

HD-1 Establish TDR receiving areas

- HD-1.1* Identify resources and their sensitivity
- HD-1.2* Establish better coordination between groups involved in defining growth areas
- HD-1.3* Educate property owners about the implementation process and related equity issues

HD-2 Protect/restore riparian and wetland buffers

- HD-2.1 Explore method for establishing statewide buffer ordinance
- HD-2.2* Define and enforce performance standards for open space, including minimizing placement and modifications of stormwater controls
- HD-2.3 Provide input to Whole Basin Management process

HD-3 Protect land in sending areas

- HD-3.1 Establish minimum requirements for open space
- HD-3.2* Provide design guidance for development in sending areas - focus on protecting contiguous areas
- HD-3.3* Periodic assessment of habitat conditions for adjusting protection/guidance measures
- HD-3.4* Explore alternative methods to ensure protection - new zoning, application of other programs, etc.

HD-4 Establish criteria/procedures for protecting uplands

- HD-4.1** Increasing public acquisition of land targeted by potential development
- HD-4.2 Coordinate acquisition efforts with other types of planning initiatives
- HD-4.3* Assess methods for downsizing - determine their viability
- HD-4.4 Establish methods for retiring unbuilt development/subdivisions (sunset)

HD-5 Endorse plans that support cluster development and preservation of open space

- HD-5.1* Improve process for implementing cluster development (analyze/modify current ordinance)
- HD-5.2* Explore incentives that help protect open space, e.g., tax incentives (federal/state/county)
- HD-5.3* Make it mandatory that information is supplied to the Development Advisory Service (DAS)
- HD-5.4 Reduce inefficient use of land by establishing minimum lot sizes or maximizing gross densities
- HD-5.5 Explore methods for placing controls on total amount of impervious surface allowed (for initial & subsequent development)

HD-6 Endorse the development of Brownfields

- HD-6.1* Develop and establish a program to encourage the restoration of Brownfield sites

HD-7 Implement new technologies/alternative WWT

- HD-7.1 Assess performance of alternatives
- HD-7.2 Assess potential partnership issues to help implement alternatives

HD-8 Minimize stormwater runoff

- HD-8.1* Improve stormwater management designs
- HD-8.2 Change stormwater control specifications
- HD-8.3 Revise existing drainage codes to prevent channelization
- HD-8.4* Retrofit stormwater controls based on reducing volume and peak discharge
- HD-8.5* Revise land-use controls relative to road improvements/construction

HD-9 Improve education and outreach efforts

- HD-9.1** Develop a land preservation tool box
- HD-9.2** Establish a means to recognize property owners and developers that help preserve natural habitats, i.e., awards program
- HD-9.3* Educate general public on planning process - what it means

Habitat Improvement and Protection Strategies

HI-1 Restore/Improve 10,000 acres of wetlands within Delaware and 3,000+ acres of wetlands within New Jersey over 10+ years

- HI-1.1** Gain access and control for restoration/improvement with/from landowners
- HI-1.2 Continue to implement NDWRP
- HI-1.3* Identify & characterize areas for restoration and improvement (Identify areas for mitigation banking; Tally up DE & NJ acreage and conditions to see what's being done; Identify available lands and programs for restoration and improvement.
- HI-1.4* Develop a program in NJ similar to DE's NDWRP

HI-2 Integrate heron foraging and nesting needs on a seasonal basis with other marsh management needs within the next 5 years

- HI-2.1** Reduce phragmites and other nuisance species by 3,000 acres throughout the PPI Region within 5 to 10 years
- HI-2.2 Clarify and Coordinate definition of "Restoration" for heron needs
- HI-2.3 Integrate water level management (includes non-wildlife approaches)

- HI-2.4** Review and make recommendations (where appropriate) existing plans for PPI needs (Evaluate existing restoration plans (DE & NJ) and Existing Wildlife Plans for PPI Benefits (State & Fed.)

HI-3 Establish minimum buffers around wetlands within 10 years

- HI-3.1** Establish criteria based on: a) type and function of wetlands area; and b) overall wildlife benefits
- HI-3.2** Incorporate buffer plans into the New Castle County Comprehensive Land Use Plan
- HI-3.3* Determine feasibility of classifying wetland values and applying buffers in New Jersey for incorporation into Exceptional Resource Value program
- HI-3.4* Restore and Re-establish buffers where previously removed

HI-4 Expand the existing available nesting habitat at the PPI Rookery by 15 acres within 10 years

- HI-4.1 Stabilize erosion of PPI within 5 years
- HI-4.2** Regenerate and perpetuate nesting habitat on the island within 5 years
- HI-4.3* Control predators on the island within 5 years
- HI-4.4* Add extra land to the island

HI-5 Expand the existing available nesting habitat outside the PPI Rookery

- HI-5.1* Identify Alternative Nesting Sites
- HI-5.2* Develop an incentive program for private landowners with herons nesting on their property with 5 years

HI-6 Improve Land Acquisition

- HI-6.1** Develop specific criteria for heronry requirements for Land Acquisition and Protection
- HI-6.2* Incorporate Heron Criteria into DE, NJ, USFWS, & Private Land Acquisition and Protection Programs. (include need for partners in this process)

HI-7 Improve Awareness & Education for the PPI Heronry Region

- HI-7.1** Communication/Outreach that creates a greater awareness of the heronry and its importance for the general public and targeted audiences.

Oil Spill and Industrial Accident Strategies

OS-1 Improve response capabilities

- OS-1.1 Prioritize Sensitive Areas for protection (revisit current ratings in Area Plan)
- OS-1.2** Produce NRDA estimates for Sensitive Areas based on the spill scenarios in the Area Plan
- OS-1.3 Stage vessel fire fighting capabilities in the Heronry region
- OS-1.4** Standardize (up) PA, DE, NJ oil transfer/booming requirements
- OS-1.5 Assess effectiveness of available response resources (especially at Sensitive Areas)
- OS-1.6* Improve/standardize spill response training (wildlife rehabilitation, NRDA evidence collection, health and safety for workers, and other topics)

OS-2 Improve the Scientific Response capability of NRDA activities

- OS-2.1 Pre-identify potential restoration projects

OS-3 Develop alternate/improved strategies for difficult areas

- OS-3.1** Pre-stage more resources at "A" rated areas for better access at sensitive locations
- OS-3.2** Address "gap" in Salem River/Mannington Meadows response plan
- OS-3.3** Establish permanent anchor points for booming

OS-4 Test/modify the current booming strategies

- OS-4.1** Drill all of the Sensitive Areas in the 15 km zone in next two years in priority order based on wading bird use

OS-5 Reduce the number of spills through better education, training, inspections, etc.

- OS-5.1 Evaluate existing preventive programs
- OS-5.2 Heighten oil/chemical industry awareness about resources in region by season
- OS-5.3 Inspect facilities based on risk, etc.

OS-6 Improve the Wildlife Response Protocol for the Area Plan

- OS-6.1** Include in the Wildlife Response Protocol a plan for 1) hazing wildlife from affected areas, 2) retrieval of wildlife, and 3) coordinating transfer of wildlife

OS-7 Develop a better understanding of spill impacts on the food chain

- OS-7.1 Better understand "off season" spill impacts on wading birds and their food chain
- OS-7.2 Better understand impacts of frequently spilled materials in highest volumes in region
- OS-7.3 Better understand potential benefits/costs of using dispersants

OS-8 Form a better understanding of the number, type, and location of accident causes

OS-8.1* Assess existing state of oil/chemical spill "risk"

OS-9 Develop education and outreach programs on spills tailored to specific audiences (general public, decision makers)

OS-9.1** Develop education and outreach programs on spills tailored to specific audiences (general public, decision makers)

OS-9.2 Get state of the spill response capability out at NEP conference or other for a

OS-10 Increase the “Oh my god!” level of awareness of Qualified Individuals

OS-10.1 Identify priority Qualified Individuals to contact

OS-10.2 Develop a presentation describing importance of heronry to East Coast wading bird populations as a whole

OS-10.3 Conduct seminar for Qualified Individuals at an existing event or as a separate function

Pesticide Strategies

PE-2 Increase use of Integrated Crop Management & Integrated Pest Management BMPs through research, education and outreach efforts

PE-2.1** Promote BMPs for implementation by agriculture, homeowners, pest control industry, right-of-way/maintenance, landscape professionals. Increase use of IPM, BMPs through education and outreach efforts

PE-2.2 Fund/encourage research to develop new BMPs

PE-2.3 Further outreach efforts to publicize BMPs

PE-3 Expand existing technical assistance & funding of programs

PE-3.1* Maintain/expand funding for USDA programs

PE-3.2* Fund two new positions (NJ & DE) or identify existing personnel for coordinating technical assistance (college interns, etc.) for PPI

PE-3.3* Identify alternate funding sources for technical assistance

PE-4 Promote improved techniques to decrease runoff

PE-4.1* Identify, catalog & rate techniques that reduce runoff

PE-4.2* Support research to develop new techniques that reduce runoff

PE-4.3 Implement best techniques

PE-6 Quantify pesticide usage in PPI heronry region

PE-6.1** Quantify relative homeowner use of pesticides

- PE-6.2** Asses compliance of pesticide use
- PE-6.3 Determine relative impact of pesticide application by landuse

PE-8 Assess positive/negative impacts of existing invasive plant control programs

- PE-8.1** Develop list of invasive plants and control efforts/programs
- PE-8.2** Assess positive and negative impacts of programs to: birds, prey species, habitat changes and nesting site availability.

PE-9 Strategies Not Specific to Any Target

- PE-9.1 Distribute research results nationally
- PE-9.2 Identify positive values of heronry (ecotourism, etc.)
- PE-9.3 Identify how effective herons are as indicators of environmental problems or health
- PE-9.4 Assess whether the 15 Km radius is sufficiently large for capturing mans' effects on the herons

Wading Bird Foraging Habitat

SPECIES	PREFERRED HABITAT	WATER CONDITIONS	WATER DEPTH	VEGETATION	TIME OF DAY	AIR TEMP AND WEATHER CONDITIONS	TIDAL CONDITIONS
Great Blue Heron	<ul style="list-style-type: none"> Freshwater, but common on seacoasts. Forages near mid-water ridges. Uses rivers and tributary systems heavily for foraging. Forages in marshy ponds 	<ul style="list-style-type: none"> Calm & slow moving. Foraging more successful when water unrippled. 	<ul style="list-style-type: none"> Preferred mean water depth of 20 cm. 	<ul style="list-style-type: none"> Prefers vegetated foraging sites maybe because vegetation attracted more fish and calmed water surface, approximately median distance to vegetation was 5 meters. Foraged most often where there was a great diversity of plant species, sites lacking submerged or emergent vegetation were avoided. 	<ul style="list-style-type: none"> Normally diurnal forager but nocturnal foraging is common, especially in tidal habitats. Foraging occurs most frequently before dawn and after dark. 	<ul style="list-style-type: none"> Foraging not affected by air temperature; successful strikes more frequent on overcast days, more successful when wind was strong. 	<ul style="list-style-type: none"> Forages in Bay at low tides and moved to ponds at high tides.
Great Egret	<ul style="list-style-type: none"> Forages in a wide variety of wetland habitats including marshes, swamps, streams, rivers, ponds, impoundments, tidal flats, canals, ditches, and fish-rearing ponds. Prey capture significantly greater in tidal channels than in mud flats; elevation of the substrate at the feeding site relative to mean low water line: 43.9 cm. Prefers foraging along levee banks but also uses mid-water ridges. Foraged in marshy ponds 	<ul style="list-style-type: none"> Preferred water turbidity: 22.3 jtu (Jackson Turbidity Units). Preferred water temperature: 26.6 C. 	<ul style="list-style-type: none"> Tends to forage in deeper water than do smaller herons. Preferred mean water depth: 20 cm. Forages in water to about 28 cm; number of Great Egrets increase with water depth to plateau at 20-40 cm depth, and then begins to decrease. 	<ul style="list-style-type: none"> Generally forages in open vegetation areas. Preferred vegetation density: 503 Spartina shoots per sq. meter; preferred vegetation height: 40.7 cm (max. stem height). Approximate median distance to nearest emergent vegetation: 1.5 meters. 	<ul style="list-style-type: none"> Foraging occurs most frequently in the morning and decreases throughout the day. 	<ul style="list-style-type: none"> Air temperature and wind speed has minimal effects on prey capture rate. 	<ul style="list-style-type: none"> Seems to select foraging sites based on tidal levels. Forages in eelgrass beds only 1.5 hours before and after low tide. Will feed all day where tide range is low.
Little Blue Heron	<ul style="list-style-type: none"> Forages in a wide variety of wetland habitats including marshes, swamps, streams, rivers ponds, impoundments, tidal flats, canals, ditches, and fish-rearing ponds. Prey capture significantly greater in tidal channels than in mud flats; elevation of the substrate at the feeding site relative to mean low water line: 43.9 cm. Prefers foraging along levee banks but also uses mid-water ridges. Foraged in marshy ponds. 	No information	<ul style="list-style-type: none"> Prefers shallow water: 5-15 cm. deep. 	<ul style="list-style-type: none"> Foraging sites are often densely vegetated. 	<ul style="list-style-type: none"> Usually forage diurnally in various aquatic habitats. 	No information	<ul style="list-style-type: none"> Appear unaffected by tidal levels in coastal foraging sites.
Cattle Egret	<ul style="list-style-type: none"> Most foraging is in association with grazing cattle or other livestock; also around margins of aquatic areas and fields where fires, tractors, or cutting machines are used; arboreal foraging is unusual but will occur if there is an abundance of insects there; surface-irrigated fields are important in arid areas. Appear to avoid marine habitats. 	NA	NA	<ul style="list-style-type: none"> Seems to prefer short vegetation; optimum foraging habitat includes open, well-watered stands of young succulent plants, mainly annual or perennial grasses that attract insects; avoid feeding in tall, dense vegetation. 	No information	No information	NA

Wading Bird Foraging Habitat

SPECIES	PREFERRED HABITAT	WATER CONDITIONS	WATER DEPTH	VEGETATION	TIME OF DAY	AIR TEMP AND WEATHER CONDITIONS	TIDAL CONDITIONS
Snowy Egret	<ul style="list-style-type: none"> • Generally prefers shallow estuarine sites for feeding including salt-marsh pools, tidal channels/flats, freshwater marshes/swamps. • Prefers open aquatic habitats. • Preferred elevation of substrate at the feeding site relative to low water line: 53.3 cm; preferred water turbidity: 20.4 jtu (Jackson Turbidity Units); preferred water temperature: 27.8 C. • Feeds equally along levee banks and along mid-water ridges. 	<ul style="list-style-type: none"> • Generally prefers brackish/marine habitats. Preferred water turbidity: 20.4 jtu (Jackson Turbidity Units). Preferred water temperature: 27.8 C. 	<ul style="list-style-type: none"> • Relatively shallow water: • Preferred water depth: 12.6 cm. • Means water depth in San Francisco Bay, CA was 3 cm, with strikes taking place in shallow water near dense vegetation. 	<ul style="list-style-type: none"> • Preferred vegetation density: 759 Spartina shoots per square meter; preferred vegetation height: 25.5 cm (max. stem height). • Prefers densely vegetated foraging sites; approximate distance to emergent vegetation 2 meters. 	<ul style="list-style-type: none"> • Mainly a diurnal feeder. • Foraging occurred most frequently in the morning and again in the afternoon. 	No information	<ul style="list-style-type: none"> • Has taken advantage of prey concentrations caused by declines in water level and areas where brackish and salt water mix.
Black-crowned Night-Heron	<ul style="list-style-type: none"> • Prefers shallow, weedy pond margins, creeks and marshes. • Essentials appear to be fresh, brackish, or saltwater feeding grounds. 	No information	<ul style="list-style-type: none"> • Use of wetlands for foraging varies with water levels. 	<ul style="list-style-type: none"> • Wetlands with equal proportions of open water and vegetation sometimes preferred. • Individuals sometimes use dry grasslands. Grassy salt marsh important for foraging. 	<ul style="list-style-type: none"> • Typically feeds at night or crepuscularly, but will feed during day in times of high food demand such as during breeding season. • Uses mudflats more at night than during the day. • Feeds most frequently in early evening. 	No information	<ul style="list-style-type: none"> • Tide seems to affect feeding area choice; birds fly farther at high tide than at low. • Feeds most frequently at low tides.
Yellow-crowned Night-Heron	<ul style="list-style-type: none"> • Forages along water margins, including tidal pools, exposed mudflats, rocky shorelines, ponds, rivers, and creeks; occasionally seen in upland sites; will use human-made aquatic habitat. • Primarily a bird of marine habitat. • Seasonally flooded emergent wetlands are important. • Feeds on crabs: fiddlers prefer solid muddy sand sheltered by marsh grass within the intertidal zone and mud crab prefers muddy bottoms with scattered debris. • Prefers long, narrow marshes with considerable edge rather than marshes with extensive interiors. 	<ul style="list-style-type: none"> • Feed primarily on crabs that prefer salinity in the range of 10-18 ppt. 	<ul style="list-style-type: none"> • Typically forages within 3 meters of water's edge in salt marshes. 	<ul style="list-style-type: none"> • Prefers marshes dominated by cordgrass. 	<ul style="list-style-type: none"> • May forage throughout day and night, but in breeding season, activity peaks in early morning and evening. 	<ul style="list-style-type: none"> • An increase in cloud cover appears to increase stationary foraging. 	<ul style="list-style-type: none"> • Most foraging occurs from 3 hours before to 3 hours after low water. Selection of foraging habitat shift with tidal stage.
Glossy Ibis	<ul style="list-style-type: none"> • Aquatic habitat and muddy substrate associated with tides or falling freshwater wetlands and reservoirs. • More common at natural sites than wastewater sites presumably because the latter are deeper water. • Will forage extensively in plowed fields, pastures, pastures with cattle, highway rights of way, parks and backyards. 	No information	<ul style="list-style-type: none"> • Tactile forager generally preferring shallow water. • Higher concentrations of ibis found in water with depth not exceeding 15 cm. 	No information	<ul style="list-style-type: none"> • Time of day may affect foraging; most active in early morning. 	No information	<ul style="list-style-type: none"> • Abundant at tidal sites during ebbing tide.

Wading Bird Nesting Habitat

SPECIES	NESTING SITE CHARACTERISTICS	VEGETATION CHARACTERISTICS	WATER AT NESTING SITES	NEST HEIGHT	NESTING SUBSTRATE	NESTING NEIGHBORS
Great Blue Heron	<ul style="list-style-type: none"> Usually lowland swamp or upland hardwood forest, islands, forest-bordered lakes and ponds, and riparian woodlands including conifers. 	<ul style="list-style-type: none"> Prefers vegetation on islands or in swamps. 	<ul style="list-style-type: none"> Nests near both fresh and salt water but GBHE in NY and NH avoid marine habitats. 	<ul style="list-style-type: none"> 30 meters or more off the ground. 	<ul style="list-style-type: none"> Nests mostly in trees; when trees not available, will nest on ground and on artificial structures. 	<ul style="list-style-type: none"> Will nest with other species of herons as well as hawks, owls, and vultures.
Great Egret	<ul style="list-style-type: none"> Colony sites located in ponds, marshes, estuaries, human-made impoundments, and on natural and dredge-made islands. 	<ul style="list-style-type: none"> Nests mostly in woody vegetation, shrubs and trees, often near the highest points in the colony. 	<ul style="list-style-type: none"> Will nests over water. 	<ul style="list-style-type: none"> Nest height varies as determined by nesting substrate. 	<ul style="list-style-type: none"> Nests typically on or near the top of trees or woody vegetation. Occasionally nests on ground or artificial nest platforms. 	<ul style="list-style-type: none"> Nests in colonies with conspecifics or other waterbirds.
Little Blue Heron	<ul style="list-style-type: none"> Shallowly flooded marshes, freshwater lagoons, and flooded grassland. Nests mostly in shrubs and small trees in standing water or upland sites, usually in less accessible sites below the canopy. Will nest on dredged-material islands. 	<ul style="list-style-type: none"> Nests in vegetation of intermediate size and stability compared to other ardeids 	<ul style="list-style-type: none"> Mostly an inland bird, but does nest in coastal areas. 	<ul style="list-style-type: none"> Nest heights are variable and determined by nesting substrate. 	<ul style="list-style-type: none"> Tends to nest in lower shrubs, bushes and small trees, usually in less accessible sites below the canopy that are protected. 	<ul style="list-style-type: none"> Usually nests with conspecifics but will nest with other herons May nest side-by-side with other herons or mostly with conspecifics.
Cattle Egret	<ul style="list-style-type: none"> Much variation in nesting sites all over NA: nests in medium to tall trees or in low trees or shrubs in swamps, adjacent to water, or on islands in fresh, brackish, or salt water Nests in heronries established by native ardeids: small tracts of isolated upland woods, inland wooded islands in reservoirs, swamps, and natural and dredge-material created coastal islands 	<ul style="list-style-type: none"> Nests in dead and live vegetation. Canopy cover of nests is variable. 	<ul style="list-style-type: none"> No information 	<ul style="list-style-type: none"> Variable; from 12 cm to 20 meters high. Nest height in Texas was about 1 meter below average height of nest plant. 	<ul style="list-style-type: none"> Sites include any spot that will support a nest and may nest on ground in dense colonies. 	<ul style="list-style-type: none"> Nests in multi-species colonies that were established by other waterbirds
Snowy Egret	<ul style="list-style-type: none"> Breeds in mixed-species colonies on relatively isolated mainly estuarine sites. Dredge spoil islands are particularly important along Atlantic and Gulf coasts because of their abundance and location near inlets where food resources are stable and abundant. 	<ul style="list-style-type: none"> No information 	<ul style="list-style-type: none"> No information 	<ul style="list-style-type: none"> Height subject to the ability the defend sites. Height closely correlated with vegetation height. Ground nesting reported in dense stands of common reed on Long Island and in s. New Jersey Mean nest heights ranged from 1.67-3.18 in various colonies on the East Coast. 	<ul style="list-style-type: none"> Common reed, woody vines, shrubs and trees. 	<ul style="list-style-type: none"> Typically nest in mixed-species colonies where the Snowy Egret is often one of the most abundant species.
Black-crowned Night-Heron	<ul style="list-style-type: none"> Use a wide variety of nesting sites, although most colonies are on islands, in swamps, or over water. Most inland colonies are associated with large wetlands. 	<ul style="list-style-type: none"> No information 	<ul style="list-style-type: none"> Will nest of over standing water. 	<ul style="list-style-type: none"> Variable nest heights: anywhere from ground level to 160 ft. 	<ul style="list-style-type: none"> Variety of substrates used for nesting is enormous; includes trees, shrubs, <i>Phragmites</i>. 	<ul style="list-style-type: none"> Will nest in mixed-species colonies.

Wading Bird Nesting Habitat

SPECIES	NESTING SITE CHARACTERISTICS	VEGETATION CHARACTERISTICS	WATER AT NESTING SITES	NEST HEIGHT	NESTING SUBSTRATE	NESTING NEIGHBORS
Yellow-crowned Night-Heron	<ul style="list-style-type: none"> •Nests on barrier, spoil, and bay islands; also in swamps, forested wetlands, and uplands near lakes, rivers, and creeks. •Seems to prefer forests with open understory. 	No information	<ul style="list-style-type: none"> •Selection of nest sites is restricted to areas near water. 	<ul style="list-style-type: none"> •Nest height is variable depending on the available substrate. 	<ul style="list-style-type: none"> •Varies geographically according to substrate availability; pine trees, oaks, sweet gum and low shrub vegetation. 	<ul style="list-style-type: none"> •Nests in colonies, although less often than most waders. •Scattered pairs and small colonies are typical, particularly inland.
Glossy Ibis	<ul style="list-style-type: none"> •Highly adaptable in nest-site selection. •Where islands available, preference for island nesting sites probably for protection against mammalian predators •Readily shifts nest sites •Has used man-made dredge material islands. 	<ul style="list-style-type: none"> •Nests on ground in extensive areas of tall marsh vegetation, or in bushes or tops of small trees that are growing in water.. •Within colonies generally nests in denser vegetation than other species and often dispersed throughout colony. 	No information	<ul style="list-style-type: none"> •In colonies with low vegetation, tends to nest on ground •Variable depending on nesting substrate: 0.6-3+ m high. 	<ul style="list-style-type: none"> •Wide variety of nesting substrates; Trees such as sweetgum, black gum, maples, junipers and cedars; shrubs such as shadbush, highbush blueberry. Also nests in Phragmites, saw grass, chord grass, and rushes. 	<ul style="list-style-type: none"> •Usually nests in mixed-species colonies, but tends to clump with conspecifics.



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